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Suaeda neuquenensis (Chenopodiaceae), a New Species from Argentina

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Abstract. *Suaeda neuquenensis*, a new species of *Suaeda* (Chenopodiaceae), is described from Añelo's Bowl near Añelo, Neuquén Province, Argentina. It differs from other perennial Argentinean species in being a decumbent shrub with creeping stems that root at the lower nodes bearing short, oblong, often reflexed leaves and a large seed.

Key words: Argentina, Chenopodiaceae, Neuquén, *Suaeda*.

Two perennial species of *Suaeda* Forsskål ex J. F. Gmelin (Chenopodiaceae), *S. divaricata* Moquin-Tandon and *S. argentinensis* Soriano, are currently known from Argentina (Soriano, 1942; Giusti, 1997). *Suaeda fruticosa* (L.) Forsskål was reported from the Boca district of Buenos Aires by Soriano (1945), who nonetheless suggested it was a recent introduction and not likely to persist; there is now no evidence that it did. Species of the genus are highly variable as to succulence, habit, and size of leaves (Morello, 1958; Hopkins & Blackwell, 1977; Bassett & Crompton, 1977; Pedrol & Castroviejo, 1988). Other features are more constant: herbaceous versus woody habit, type of inflorescence (including the density of the glomerules), relationship of leaf length and internode length, shape of the calyx, stigma shape and length, and seed size (Hopkins & Blackwell, 1977; Pedrol & Castroviejo, 1988).

Material and Methods

Dried specimens of *Suaeda* at ARC, CORD, and MERL were studied, as well as fresh material collected in the Neuquén Province.

Taxonomic and nomenclatural treatments follow Standley (1916), Morello (1958), Bassett and Crompton (1977), Hopkins and Blackwell (1977), Correa (1984), Pedrol and Castroviejo (1988), Teiller (1996), Guisti (1997), Greuter et al. (2000), and Schenk and Ferren (2000, 2001). Herbarium sheets of *Suaeda neuquenensis* are conserved at ABH of the University of Alicante (Holmgren & Holmgren, 1993).

Results and Discussion

Suaeda neuquenensis M. A. Alonso, Conticello & Cerazo, sp. nov. TYPE: Argentina. Neuquén Province: Añelo's Bowl near Añelo, 38°11′56″S, 69°00′46″W, 350 m.s.m. on saline-sodic soil, 24 Mar. 1998, *L. Conticello & M. A. Alonso s.n.* (holotype, ABH 41516; isotype, ABH 42972). Figure 1.

Nanophanerophitus in fructicibus pulvinatis usque ad 50 cm altitudinis et 2.50 m diametri se extendentibus. Caulis atramineus leviter striatus, glaber cum internodiis 1 mm, interdum inaestimabilis in gemmis recentibus, 2–3 mm longis in ramis adultis. Folia adulta patentia aut reflexa, iuvenilia perpendicularia, alterna oblonga, succulenta cum apice obtuso ac leviter mucronato, parum aut

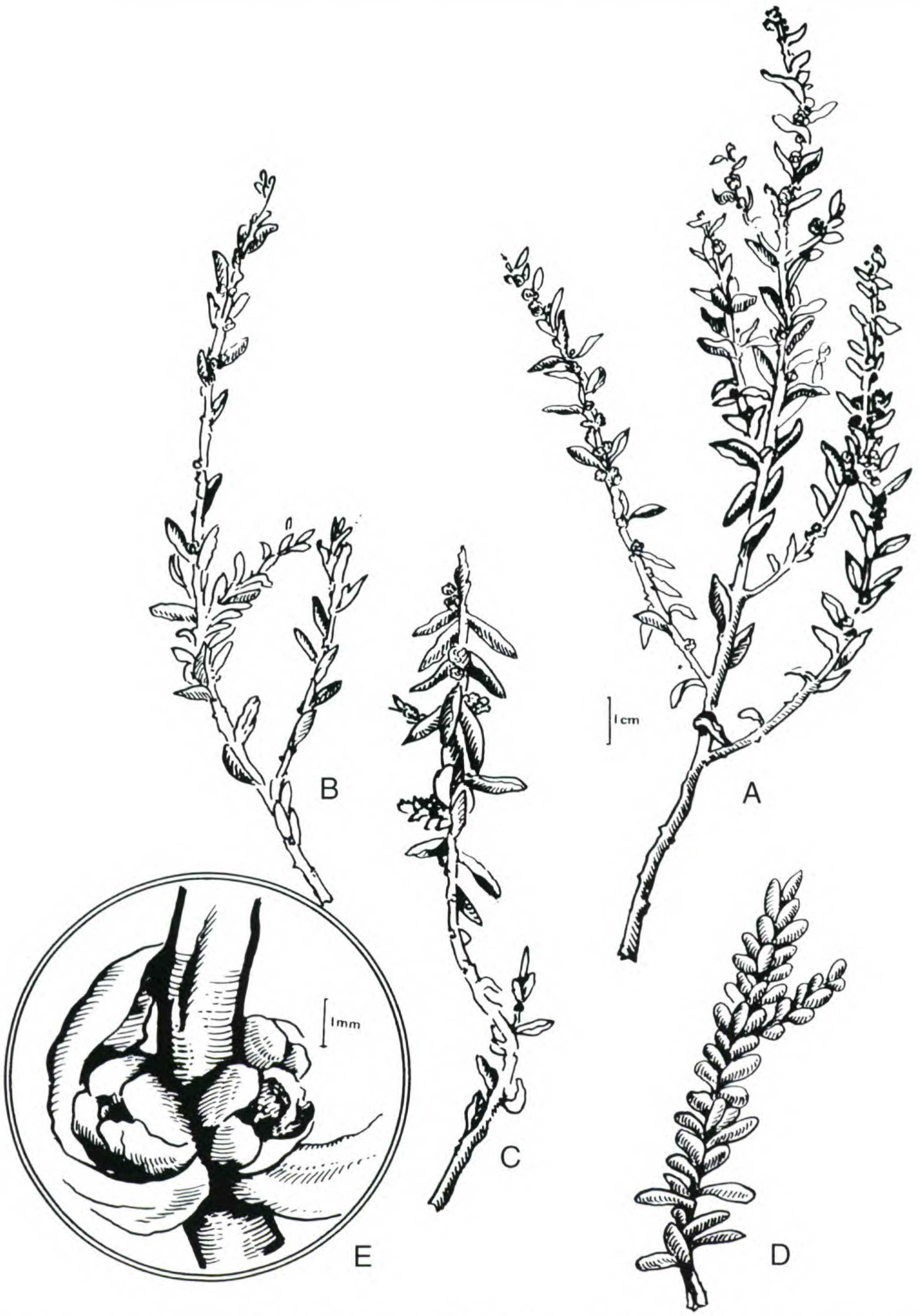

Figure 1. *Suaeda neuquenensis* M. A. Alonso, Conticello & Cerazo. —A. Habit (holotype, ABH 41516). —B, C. Flowering branches. —D. Young sterile shoot. —E. Detail of an axillary floral glomerule from the holotype.

nihil ad basim attenuata, dorsiventraliter compressa, margines integri et rotundi, cum nitore virentia aut glauca vel albescentia propter salina corpuscula quae in superficie deponuntur, 5–15 mm longa et 3–8 mm lata. Gynodioecius, sessiles flores iuncti in glomerulis axillaribus 2–6, hermaphroditi cum sterili gynaecio, 5 staminibus et calyx 5 sepalorum. Flores feminei cum gynaecio fecundo unioculari, stylis 3 ad 0.5 mm longis, stigmatibus papillis elongatis atque pilis acutis vestitis. Flores isti minores sunt quam hermaphroditi, sed dia parte eius, et cum apice

abtuso glabris ac inflexis, 2–3 mm longi. Fructus utriculatus, ovoideus, 3 × 4 mm, in calycis segmentis inclusus sed illis non affixus. Semen verticale, nigrum, lenticulare, testa reticulata.

Plants woody, cushion-shaped, dwarf shrubs with creeping stems, forming mats 20–50 cm high and 25 dm across, the decumbent branches rooting at the nodes. Stems light brown, weakly striated, the internodes of new branches 1 mm long or less, 2–3 mm long in mature branches. Leaves alternate and positioned perpendicular on new branches, becoming reflexed on mature branches, succulent, oblong, 5–15 mm long, 3–8 mm wide, entire, shining green to glaucous or white due to saline deposited on the surfaces, the apices obtuse to rounded or slightly mucronate, the bases attenuated. Flowers gynodioecious, axillary, sessile, 2 to 6 per glomerule, the perianth composed of 5 sepaloid perianth segments, 2–3 mm long, these inflated in the middle, apically obtuse and inflexed, the hermaphrodite flower with 5 stamens and a sessile, sterile gynoecium, the female flowers with a solitary, 1-locular gynoecium with 3 stigmas up to 0.5 mm long, bearing elongate papillae and acute hairs. Fruit an ovoid utricle, 3 × 4 mm, enclosed by the perianth segments, which are not closely attached to it; seeds vertical, black, lens-shaped, reticulate on the testa.

Ecology. *Suaeda neuquenensis* is known only from Añelo's Bowl near Añelo in the province of Neuquén, where it occurs on saline-sodic soils in monospecific communities or in association with *Atriplex undulata* (Moquin) Dietrich, *Distichlis spicata* (L.) Greene, *Halophytum ameghinoi* Spegazzini, *Sesuvium portulacastrum* (L.) L., and *Suaeda divaricata*.

Taxonomic Discussion

In a recent paper on the nomenclature of *Suaeda*, Schrenk and Ferren (2001) stressed features characterizing sections in the genus. According to their arrangement, *Suaeda neuquenensis* belongs to section *Limbogermen* Iljin (sect. *Salsina* Moquin, pro parte), which includes American shrubs and subshrubs, with radial flowers, stigmas from a pit at the top of the ovary, and leaves with suaedoid C_4 anatomy, consisting of a ring of dark green palisade and Kranz cells surrounding internal aqueous tissue, among other characters.

Relationships among taxa of section *Limbogermen* are shown in Table 1. Morphologically, *S. neuquenensis* shows a syndrome of characters that is not found in other South American taxa in the section. Stems are decumbent and root at the basal nodes, a feature that is absent in both *S. argentinensis* and *S. divaricata*; seeds are vertical and have a reticulate testa (neither horizontal and smooth as in *S. argentinensis*, nor tuberculate as in *S. divaricata*). With regard to other American species, *S. neuquenensis* resembles *S. conferta* (J. K. Small) I. M. Johnston by its delicate cushion-shaped habit, though it differs by its robust, strongly woody stems, large fruits up to 4 × 3 mm (the largest in the section), and its narrower and shorter leaves, among other features. Connections to other Central and North American taxa are very weak.

It is unlikely that *Suaeda neuquenensis* is an exotic, introduced taxon. Its natural habitat is quite far from populated or frequented areas, and the soil in which it grows has a high salt content, making it unsuitable for agriculture. It is difficult therefore to support an alien origin for this plant, since no taxon is currently known to which it could be referred.

Key to Related Species of *Suaeda* in the Argentine Republic

The following is part of Giusti's (1997) key for the genus *Suaeda*, to which *S. neuquenensis* has been added.

1a. Shrubs or small shrubs.
  2a. Plants with ramification in acute angles. Leaves appressed to stem. Flowers in axillary, pedicellate glomerules. Seeds usually horizontal . . . . . *Suaeda argentinensis*
  2b. Plants with ramification in divergent angles. Leaves divergent, not appressed to stem. Flowers in axillary, sessile glomerules. Seeds vertical.
    3a. Shrubs erect, 1–3 m high. Leaves semicylindric, perpendicular to the stem. Young stems downy. Stems brown to reddish . . . . . *Suaeda divaricata*
    3b. Shrubs decumbent, 0.2–0.5 m high. Leaves flat, reflexed on the stem. Young stems glabrous. Stems light brown . . . . . *Suaeda neuquenensis*
1b. Annual herbs . . *Suaeda patagonica*, *Suaeda altisima*, and *Suaeda densiflora*

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Table 1. Comparison of morphological features among the species of *Suaeda* sect. *Limbogermen*.

Features	*Suaeda divaricata* Moquin-Tandon	*Suaeda argentinensis* Soriano	*Suaeda neuquenensis* M. A. Alonso et al.	*Suaeda conferta* (J. K. Small) I. M. Johnston	*Suaeda tampicensis* (Standley) Standley	*Sueda taxifolia* (Standley) Standley	*Suaeda californica* S. Watson	*Suaeda nigra* (Rafinesque) Mcbride	*Suaeda palmeri* (Standley) Standley	*Suaeda foliosa* Moquin-Tandon
Habit	erect	erect	decumbent branches rooting at the nodes	prostrate, decumbent	erect, decumbent	erect	decumbent	erect	erect	erect
Height (m)	1–3	0.5–2	0.2–0.5	0.2–1	—	up to 1.5	0.3–0.8	0.2–1.5	—	0.3–0.5
Stem color	brown to reddish	light brown and striated	light brown and striated	light brown	green	gray-brown	gray-brown	dark red	white tomentulose	brown to reddish
Stem surface	downy	glabrous	glabrous	glabrous	densely tomentulose	densely hairy	glabrous	pubescent to tomentose	white tomentulose	glabrous
Leaf size (mm)	10–50 × 2–3	25 × 15	5–15 × 3–8	2–10 × 1–2	7–22 × 0.5–1.5	30 × 0.5–1.5	5–35 × 0.5–1.5	10–30 × 1–2	3–7 × 1.5–2	3–5 × 10–20
Leaf shape	semicylindrical, basally attenuated	semicylindrical, not attenuated	oblong, only slightly attenuated, depressed	oblong, short-petiolate	subsessile, short-petiolate	subcylindrical, subsessile	subcylindrical, subsessile	subcylindrical, sessile or short-petiolate	terete	subcylindrical, subsessile
Leaf surface	sparsely pubescent	glabrous	glabrous	glabrous	glabrous	glabrous or pubescent	glabrous	glabrous or pubescent	white tomentulose	glabrous
Apex	acute		obtuse to nearly rounded	rounded	acuminate	acute to acuminate	acute	obtuse	rounded	acuminate
Number of flowers	3–7	3–5	2–6	1–5	1–5	1–3	1–5	1–12	1–2	1–9
Perianth surface	long hairs (1 mm)	glabrous	glabrous	glabrous or pubescent	glabrous	hairy	glabrous	glabrous or pubescent	glabrous	glabrous
Number of stigmas	3–4	3–4	3	2–3	3	3–4	3	2–3	3	2
Fruit size (mm)	1.5–2 × 1	1.5 × 1.5	4 × 3	2–3	0.8–1	1–3	1.5–2	0.7–2	1.5–2	1.5–2
Seed position	vertical	usually horizontal	vertical	horizontal or vertical	horizontal	horizontal or vertical	horizontal or vertical	horizontal or vertical	horizontal	vertical and horizontal
Seed size (mm)	1.5–2 × 1	1.5 × 1.5	4 × 3	0.8 × 1.2	0.8–1	1–2	0.8–1.2	0.5–2	1.5	0.8–2
Surface of testa	tubercled	smooth	reticulate	reticulate	reticulate	smooth	reticulate	reticulate	smooth	smooth

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Two New Species and Two New Combinations in *Rhynchospora* Sect. *Pluriflorae* (Cyperaceae)

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ABSTRACT. While revising *Rhynchospora* sect. *Pluriflorae* Kükenthal, two species new to science were discovered and are described here. Furthermore, two new combinations are proposed, and lectotypifications of two of Kükenthal's names are proposed. The morphological variability of the species is discussed and related to their geographic distribution.

RESUMO. Durante a revisão taxonômica de *Rhynchospora* sect. *Pluriflorae* Kükenthal, foram encontradas duas novas espécies para a Ciência, as quais estão sendo descritas neste trabalho. Além disso, duas novas combinações estão sendo propostas. São tambem propostas a lectotipificação de duas espécies de Kükenthal. A variabilidade morfológica das espécies e discutida e relacionada com dados de distribuição geográfica.

Key words: Brazil, Cyperaceae, *Rhynchospora* sect. *Pluriflorae*.

Rhynchospora Vahl is the third largest genus of Cyperaceae, with approximately 250 species, and is most diverse in the Neotropics (Thomas, 1994; Koyama, 1972). In his revision of the genus, Kükenthal (1949) accepted two subgenera: subg. *Rhynchospora*, characterized by a bifid style, and subg. *Haplostylis* (Nees) Pax, characterized by an entire or briefly divided style. The subgenus *Haplostylis* comprises seven sections arranged in two informal groups, Anthelatae and Capitatae, the latter with two sections, *Pauciflorae* and *Pluriflorae*. Section *Pluriflorae* can be recognized by characters of the inflorescence, perigonial bristles, and achenes. The species of section *Pluriflorae* occur exclusively in the Neotropics, especially in Brazil between 500 and 2000 m, mainly in savannas, including the cerrado, and campo rupestre vegetation.

While revising *Rhynchospora* sect. *Pluriflorae*, the review of herbarium collections, analysis of populations in the field, and studies of leaf anatomy revealed species new to science and made necessary the change in rank of some previously recognized taxa. In this paper, two species are described and two new combinations are proposed.

Rhynchospora eurycarpa A. C. Araújo & H. M. Longhi-Wagner, sp. nov. TYPE: Brazil. Mato Grosso: Mun. Rondonópolis, BR 163, 113 km após a cidade, 500 m após a Polícia Rodoviária em direção a Cuiabá, 26 Nov. 1997, *A. C. Araújo, A. Zanin, M. G. L. Wanderley, R. Forzza & Rita Lima 933* (holotype, ICN; isotypes, NY, SPF). Figure 1.

Rhynchosporae hispidulae proxima sed glumis pallidis (nec castaneis), setis perigonii carentibus, fructu latiori 1.7–2.3 mm (nec 1.4 mm), margine fructus apicem versus tantum curvatum et styli basi late triangulari distat. Proxima etiam *R. elatiori* sed laminis crescentiformibus (nec planis), bracteis involucri angustioribus 0.3–0.9 mm (nec 1.5–5 mm) latis, spiculis latioribus 2.5–3 mm (nec 1–2.2 mm) latis et setis perigonii carentibus distat.

Plants 40–70 cm tall, erect. Culm 1 mm wide, cylindrical, rarely triangular, glabrous, the culm bases sub-bulbiform and 0.7–1 cm wide. Leaves basal, (3)5 to 8; sheath 4–5(7) cm long, becoming fibrous when old, glabrous, rarely pilose at the apex; blade (15)20–40 cm × (0.4)1.2–1.8 mm, at least half the height of the culm, linear, convolute, gla-

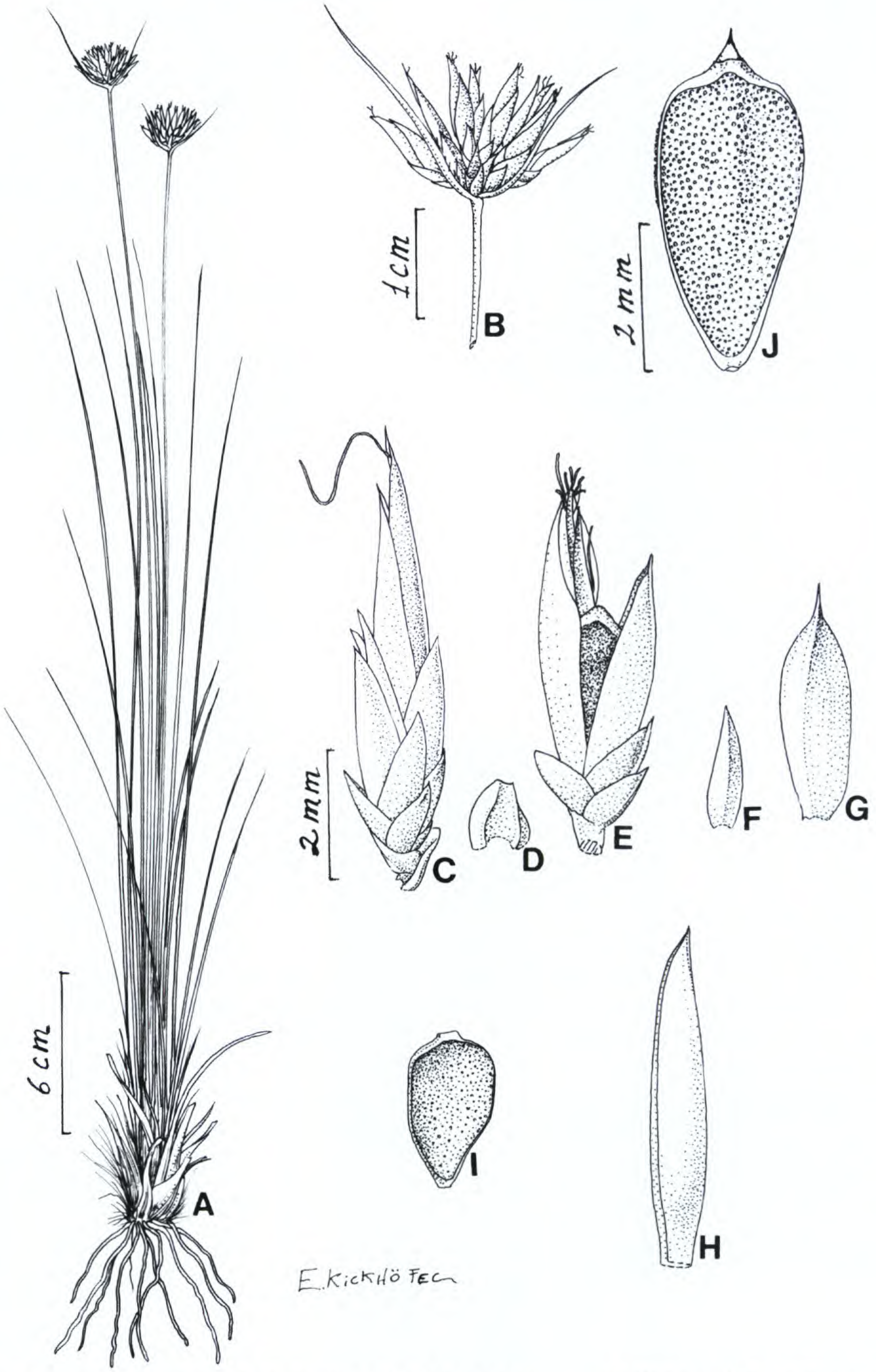

Figure 1. *Rhynchospora eurycarpa* A. C. Araújo & H. M. Longhi-Wagner. —A. Habit. —B. Capitulum. —C. Closed spikelet. —D. Prophyll. —E. Opened spikelet revealing achene. —F. Empty basal spikelet scale. —G. Spikelet scale subtending achene. —H. Spikelet scale subtending lowest staminate flower. —I, J. Achene. (Based on *A. C. Araújo 933.*)

Table 1. Diagnostic characters for *Rhynchospora eurycarpa* A. C. Araújo & H. M. Longhi-Wagner, *R. elatior* Kunth, and *R. hispidula* Grisebach.

Characters	*R. eurycarpa*	*R. elatior*	*R. hispidula*
Leaf blade	crescentiform	flat	flat
Bulliform cells	absent	present	present
Involucral bract width	0.3–0.9 mm	1.5–5 mm	1–1.4 mm
Spikelet width	2.5–3 mm	1–2.2 mm	1.8–2 mm
Achene width	1.7–2.3 mm	0.9–1 mm	1.4 mm
Perianth bristles	absent	6, scabrous	6, scabrous

brous on both surfaces, scabrous along the margins. Inflorescence capitate subtended by 2 or 3 involucral bracts; involucral bracts similar to leaf blades, linear, flat, green, coriaceous; first bract 1.5–3(4.5) cm × 0.3–0.9 mm, the margins scabrous; second bract 0.7–1.8 cm × 0.3–0.6 mm. Capitulum 7–12 × 10–20 mm, hemispherical. Spikelets (6)10–20, 7–8 × 2.5–3 mm, lanceolate, the basal 3 or 4 scales empty, followed by 1 scale (rarely 2) subtending a perfect flower, and 5 to 7 distal scales subtending staminate flowers; distal empty scale stramineous to creamy white, chartaceous, 3–5 × (1)2–2.7 mm, ovate-lanceolate, glabrous, mucronate at the apex; scale of the perfect flower 5–7 × 2.7–3.6 mm, ovate-lanceolate, stramineous to creamy white, chartaceous, glabrous, the apex acute or apiculate; scale of the basal staminate flower stramineous to creamy white, chartaceous, glabrous, the other staminate scales membranous. Perianth bristles absent. Anthers 2 or 3 mm long. Achenes 3.8–5.8 × 1.7–2.3 mm, widely obovate, laterally compressed, dark brown, the surface papillose, the margins cartilaginous, sparsely scabrous; style base 0.3–0.4(1.2) × 0.8–1 mm, triangular with an abrupt constriction near the base, not decurrent, its insertion confluent with the summit of the achene, the margins straight.

Rhynchospora eurycarpa is known only from the cerrado in the central-western region of Brazil. This species is similar to *R. elatior,* from which it differs in having a wider achene, shorter style base, and narrower involucral bracts. The foliar anatomy of these two species also differs (Table 1).

Paratypes. BRAZIL. **Goiás:** Mun. Mineiros, Parque Nacional das Emas, 3 Jan. 1993, *F. A. Vitta et al. 173, 199* (SPF); estrada de acesso à sede do Parque, em direção ao portão Jacuba, próximo ao Rio Formoso, 25 Nov. 1997, *A. C. Araújo et al. 917* (SPF). **Mato Grosso:** Mun. Chapada dos Guimarães, 7 Jan. 1979, *A. Maciel 15* (INPA); Colégio de Buriti, 720 m, 13 Oct. 1973, *G. T. Prance et al. 18923* (NY); Mun. Cuiabá, rodovia para Santarém/Porto Velho, arredores do aeroporto, *M. G. Silva & A. Pinheiro 4530* (CH); Mun. Dona Rosa, 12°54′S, 51°52′W, 270 km N de Xavantina, Oct.–Nov. 1967, *J. Ramos & R. Souza 195* (NY); 12°49′S, 51°46′W, 9 Jan. 1968, *D. Philcox & A. Ferreira 3943* (NY, RB); Mun. Rio Brilhante, Casa Branca, 12 Feb. 1970, *G. Hatschbach 23619* (NY); BR 267, no entroncamento do município, 22 Oct. 1970, *G. Hatschbach 25029* (MBM, NY); rodovia Presidente Prudente, em direção a Campo Grande, km 180, 9 June 1976, *H. F. Leitão Filho et al. 2094* (UEC); Mun. Xavantina, rodovia para Cachimbo, km 247,5 E da rodovia, 8 dec. 1967, *D. Philcox et al. 3440* (NY). **Mato Grosso do Sul:** Mun. Campo Grande, BR 163, próximo de Água Ruim, 14 Aug. 1970, *G. Hatschbach & O. Guimarães 24635* (MBM).

Rhynchospora paranaënsis A. C. Araújo & W. W. Thomas, sp. nov. TYPE: Brazil. Paraná: Mun. Ponta Grossa, Vila Velha, 7 Oct. 1971, *G. Hatschbach 22332* (holotype, MBM; isotypes, HB, MO, RB, UEC, US). Figure 2.

Rhynchosporae warmingii affinis sed laminis planis (nec convolutis), nec fibrosis senescentibus, bracteis involucri brevioribus, bractea basali ad basin magis latescenti 2.4–3.2 mm longa (nec 1–2.2 mm), setis perigonii carentibus differt.

Plants 20–30 cm tall, erect, rhizomatous with knotted rhizomes, the knots 0.6–1 cm wide. Culm 0.8–1 mm wide, cylindrical, glabrous. Leaves 2 or 3; sheath 5–8 cm long, not becoming fibrous when old, glabrous; blade 10–17 cm × 2.4–2.7 mm, half the height of the culm, linear-lanceolate, symmetrical, flat, the margins scabrous or sparsely hairy. Inflorescence subtended by 2 involucral bracts; involucral bracts foliar, basally white and ovate, distally green and linear-lanceolate, flat, chartaceous, the apex acuminate; basal bract 2.4–3.2 cm long, the white portion 0.5 × 0.4–0.6 cm, the green portion 1.9–2.7 × 0.8 cm, the margins scabrous; second bract 1.5 × 0.6 cm. Capitulum 6–8 × 8 mm, hemispheric. Spikelets 10 to 15, 4.4–5.4 × 1.8–2.4 mm, ovate to ovate-lanceolate, the basal 3 scales empty, followed by a single scale subtending a perfect flower and 3 to 6 distal scales subtending staminate flowers; distal empty scale 4–4.6 × 1.8–2 mm, lanceolate, ochraceous, glabrous, the apex acute; scale of the perfect flower 4.4–5 × 2–2.5 mm, ovate-lanceolate, ochraceous, chartaceous,

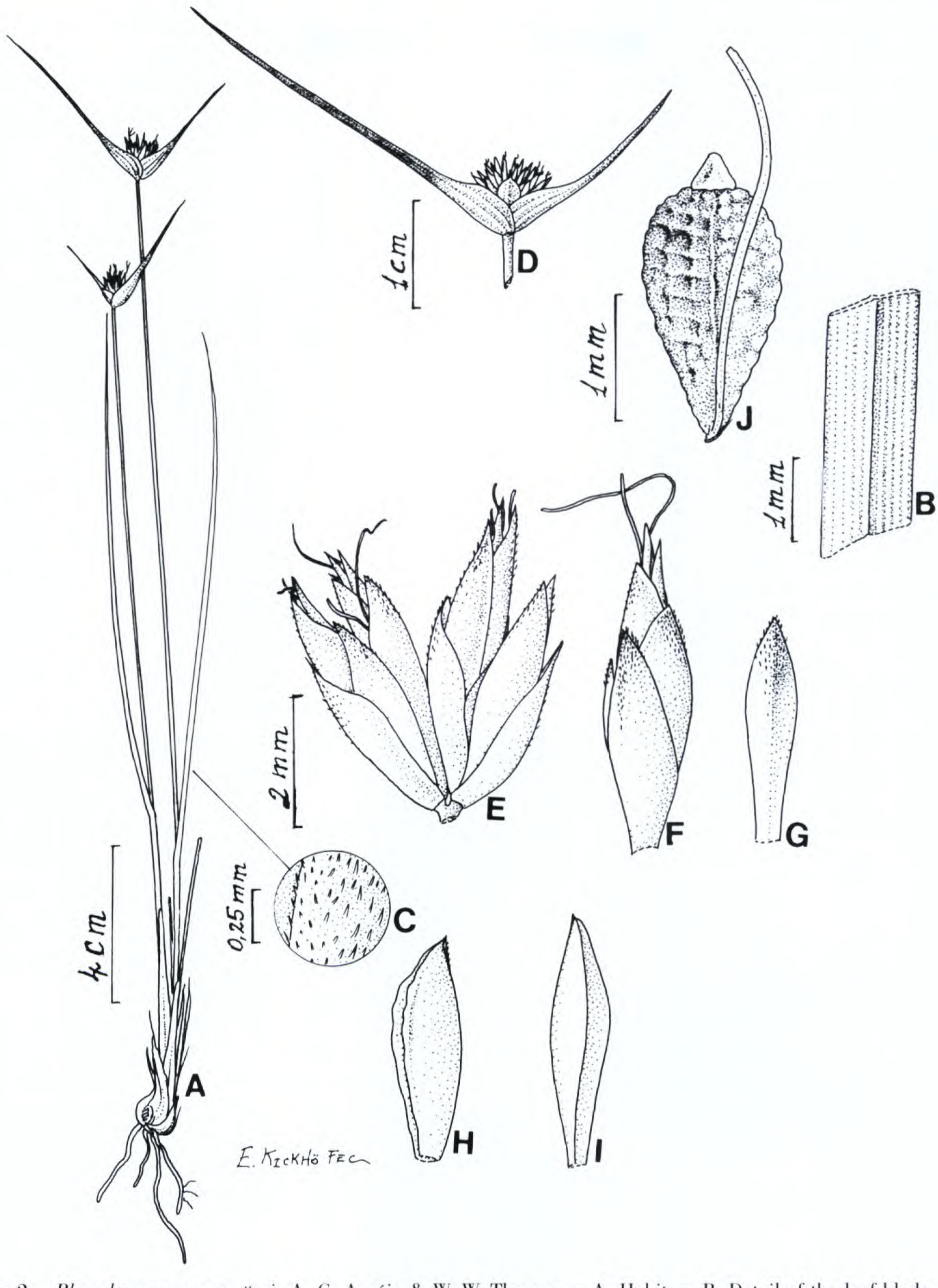

Figure 2. *Rhynchospora paranaënsis* A. C. Araújo & W. W. Thomas. —A. Habit. —B. Detail of the leaf blade. —C. Detail of the surface of the leaf blade. —D. Capitulum. —E. Group of spikelets. —F. Spikelet. —G. Basal empty spikelet scale. —H. Spikelet scale subtending achene. —I. Spikelet scale subtending lowest staminate flower. —J. Achene. (Based on *G. Hatschbach 22332*.)

scabrous along the keel, the apex acute; scale of staminate flowers stramineous, the basal one chartaceous, the others membranous. Perianth bristles absent. Anthers 2.6 mm long. Achenes 1.8 × 1 mm, obovate, biconvex, ochraceous, the surface tuberculate, the margins not prominent, straight; style base 0.2–0.3 × 0.3 mm, conical, not decurrent, confluent along margins of the achene.

The type material of *Rhynchospora paranaënsis*

was collected over 30 years ago and was identified as the similar *R. warmingii* Boeckeler. *Rhynchospora paranaënsis*, however, differs from *R. warmingii* in having leaf sheaths that do not disintegrate into fibers as they age; leaf blades and green portions of the involucral bracts that are flat and not convolute; spikelet scales that are scabrous; and the absence of perianth bristles. So far, *R. paranaënsis* is known only from two collections from the state of Paraná in southern Brazil. Although many attempts have been made to re-collect this species in the field, it has not been found again.

Paratype. BRAZIL. **Paraná:** Mun. Colombo, Rio Canguiri, 3 Oct. 1966, *G. Hatschbach 17262* (MBM).

In addition to the two new species described above, the following two combinations are proposed here for the first time.

Rhynchospora elatior var. **brevispiculosa** (Kükenthal) A. C. Araújo, comb. nov. Basionym: *Rhynchospora diamantina* var. *brevispiculosa* Kükenthal, Feddes Repert. Spec. Nov. Regni Veg. 53: 72. 1944. TYPE: [Brazil.] Minas Gerais: Conselheiro Matta auf moorigem Sandboden, 1200 m, June, *Brade 13515* (lectotype, designated here, RB).

Haplostylis minor Nees, in Martius, Fl. Brasil. 2: 129. 1842. Non *Rhynchospora minor* Nees (in Martius, Fl. Brasil. 2: 143. 1842), nec Nelmes (in Kew Bull. 1956: 533. 1957 nom. illeg.). TYPE: Brazil. Goiás: "Serra dos Cristais," *Pohl 5032* (holotype, W destroyed; fragment of type, B; photo of type, MO).

Haplostylis minor (Nees) Steudel, Syn. Pl. Glum. 2: 143. 1855, nom. illeg.

Rhynchospora leucostachys Böckeler, All. Bot. Zeitschr. 2: 79. 1896. TYPE: "Brasilia: Minas," *Glaziou 20047* (holotype, C; isotype, K, photos of type: F, MO).

Rhynchospora diamantina Kükenthal, Repert. Spec. Nov. Regni Veg. 53: 72. 1944. TYPE: Paraguay. "Am Oberlauf des Flusses Apa," Oct. 1901, *Hassler 7698* (lectotype, designated here, NY; isotypes, K, MO, P). Syntypes: "Rio Apa und Rio Aquidaban, Villa Sana," 21 Jan. 1909, *K. Fiebrig 4676* (B fragment, K, M, P); Brazil. Minas Gerais: "Sierra do Catuny," 900 m, 10 Nov. 1938, *F. Markgraf 3303* (RB? not seen); Brazil. Minas Gerais: "Riacho das Varas und Sopa, Diamantendistrikt," 22 Mar. 1892, *W. Schwacke 8432* (RB? not seen).

Rhynchospora elatior includes plants from 0.7 to 1.5 m tall, with large, bulbose rhizomes, culms 4–7 mm wide, leaf blades 7–11 mm wide, and capitula 12–30 mm wide with 100 to 150 spikelets. This variable species was divided into four varieties by Kükenthal (1949): the typical variety, *R. elatior* var. *burchelli* (C. B. Clarke) Kükenthal, *R. elatior* var. *hirsuta* Nees, and *R. elatior* var. *variegato-pes* Pfeiffer. Although recent study of *R. elatior* (Araújo, 2001) supports only the separation of one of the varieties Kükenthal recognized (*R. elatior* var. *hirsuta* Nees), another taxon, commonly identified as *R. diamantina* Kükenthal, is here proposed as another variety of *R. elatior*: *R. elatior* var. *brevispiculosa*. This variety occurs in campo rupestre vegetation over 1000 m elevation in the state of Minas Gerais and is common near the town of Diamantina. Plants of this variety are small (20–55 cm tall), have few spikelets per capitulum (20 to 25), have narrow and short leaf blades, and are basally distichous. Plants of *R. elatior* var. *elatior* from the states of Goiás and Bahia are more robust: 70–140 cm tall, 100 or more spikelets per inflorescence, and leaf blades that are larger and rosulate. There are, however, no morphologically discontinuous characters between the Diamantina populations and the populations to the north and west.

Plants with the morphology of *Rhynchospora elatior* var. *brevispiculosa* were first described as *Haplostylis minor* Nees (1842). Steudel (1855) transferred this species to *Rhynchospora*, proposing an illegitimate combination—the species *R. minor* Nees had previously been described. Boeckeler (1896) described a new species, *R. leucostachys*, citing as the type *Glaziou 20047*, which matches this taxon in all respects. However, having not seen the type of *R. leucostachys* Boeckeler, Kükenthal (1944) described a new species typified by similar collections as *R. diamantina*. Despite being accepted as a good species by many authors (usually under the name of *R. diamantina*), study of a much larger body of collections than was previously available confirms that there is no clear morphological discontinuity in any taxonomic character that would permit the recognition of these two entities as distinct species.

The new combination had to take the name *Rhynchospora elatior* var. *brevispiculosa*, even though the typical variety of *R. diamantina* is included in the synonymy. *Rhynchospora diamantina* was illegitimate when published because Kükenthal included as one of the syntypes the type of Boeckeler's earlier name, *R. leucostachys*. Therefore, the autonymic variety created when Kükenthal published *R. diamantina* var. *brevispiculosa* is also illegitimate and cannot be used. Boeckeler's *R. leucostachys* is legitimate but was never used to create a name at the varietal level. Likewise, Steudel's illegitimate *R. minor* was never the basis for any varietal names. Therefore, the name *brevispiculosa* is the earliest available name and must be used in recognizing this taxon as a variety of *R. elatior*.

The specimen *Brade 13515* was chosen as the lectotype of *Rhynchospora elatior* var. *brevispiculosa*

because *Pohl 5032*, a syntype, is, in fact, the type of *Haplostylis minor*.

Rhynchospora terminalis var. **rosemariana** (D. A. Simpson) A. C. Araújo, stat. nov. Basionym: *Rhynchospora rosemariana* D. A. Simpson, Kew Bull. 44: 289. 1989. TYPE: Brazil. Minas Gerais: Serra do Cipó, Santana do Riacho, 3 Mar. 1981, *Mayo et al. SPF 19551* (holotype, SPF; isotype, K).

Simpson (1989) reported that *Rhynchospora rosemariana* and *R. terminalis* (Nees) Steudel were related but distinct species distinguishable by characters of the involucre, involucral bracts, spikelet scales, and achenes. Studies of herbarium collections as well as living populations show a greater variation within *R. terminalis* than previously recognized. This variation diminishes the diagnostic value of the characters Simpson used to separate the two species. The main characters used by Simpson (1989) to distinguish *R. rosemariana* from *R. terminalis* are: ciliate versus scabrous involucral bracts, capitula single versus fascicles of spikelets, and the achenes 3.4–4.7 versus 4–6 mm long.

The involucral bracts are basally glabrous in most collections of *Rhynchospora rosemariana* from the same population at "Serra do Cipó" (Minas Gerais). In *R. terminalis* the involucral bracts are normally scabrous, although some collections are also ciliate. The lowest one or two involucral bracts in *R. terminalis* may subtend separate small capitulae or small fascicles of spikelets. However, in some populations of this species only the single terminal capitulum is found.

The study has proved that there is wide variability in spikelet length in *Rhynchospora terminalis*, which encompasses the whole range of spikelet lengths for *R. rosemariana*. In the same way, the achene is greater in *R. terminalis* (4–6 mm), but there is an overlap in the size range between the two taxa.

Rhynhchospora terminalis, typically from cerrados, is also known from areas of campo rupestre in Espinhaço Range, such as the Serra da Moeda (Moeda, Minas Gerais). While *R. rosemariana* is restricted to campos rupestres in the Serra do Cipó Mountain (Simpson, 1989), it was found in cerrado fields in Mato Grosso state, too.

The following characters can be used to distinguish *R. terminalis* var. *rosemariana* from the typical variety: plants glabrous versus glabrous to densely pilose; lamina 1.5–3 cm long versus 10–25 cm long; capitulum with 10 to 20 spikelets versus 10 to 40 spikelets; spikelet scale subtending achene dark castaneous versus stramineous to pale castaneous.

Material examined (*Rhynchospora terminalis* var. *rosemariana*). BRAZIL. **Mato Grosso:** Mun. Cuiabá, Serra Ricardo Franco, 25 set. 1978, *P. Windisch 2129* (CH). **Minas Gerais:** Mun. Diamantina, para Curvelo, 11 milhas após Diamantina, 23 Dec. 1959, *B. Maguire et al. 44764* (NY, SPF); Guinda, Curvelo-Diamantina, 23 Nov. 1985, *W. Thomas et al. 4857* (MO, NY, SPF, US); BR 259, km 583, 10 Dec. 1997, *A. C. Araújo & A. Zanin 1045* (ICN, SPF); Mun. Jaboticatubas, Parque Nacional da Serra do Cipó, 5 Mar. 1958, *E. P. Heringer & Castellanos 6177* (UB, US); MG 010, da Vila Almeida para Conceição do Mato Dentro, entre os km 114 e 116, 10 Mar. 1969, *G. Eiten & L. T. Eiten 10963* (UB); km 139, 8 June 1970, *A. B. Joly et al. 306* (MBM, UEC); Mun. Paraopeba, Fazenda Rasgão, 30 out. 1959, *E. P. Heringer 7272* (UB); Mun. Santana do Riacho, Parque Nacional da Serra do Cipó, MG 010, km 120, 16 fev. 1968, *H. S. Irwin 20284* (F, MO, NY, RB, US); Fazenda Palácio, 18 out. 1972, *G. Hatschbach et al. 28846* (MBM, MO, UPCB), 14 May 1997, *A. C. Araújo & F. A. Vitta 750* (ICN, SPF), 23 set. 1997, *A. C. Araújo et al. 841* (ICN, SPF), 8 Dec. 1997, *A. C. Araújo et al. 976* (ICN, SPF); Mun. São Roque de Minas, arredores do Parque Nacional da Serra da Canastra, 19 Mar. 1998, *A. C. Araújo et al. 1115* (ICN, SPF).

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Two New Species of *Meliosma* (Sabiaceae) from Bolivia

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Abstract. Two undescribed species of *Meliosma* Blume have been found during revision of the Bolivian material of the genus for the checklist of the Bolivian vascular plants: *Meliosma minutipetala* Arbeláez, having the smallest inner petals of any *Meliosma* species reported from the Neotropics, and *M. petalodentata* Arbeláez, having both the outer and inner petals dentate. A key to the eight species known from Bolivia is provided.

Resumen. Dos especies aún no descritas del género *Meliosma* Blume fueron encontradas durante la revisión del material boliviano de este género para el "checklist" de las plantas vasculares de Bolivia: *Meliosma minutipetala* Arbeláez, la cual tiene los pétalos internos más pequeños de todos aquellos reportados previamente para cualquier especie de *Meliosma* en los Neotrópicos, y *M. petalodentata* Arbeláez, la cual tiene tanto los pétalos externos como los internos dentados. Se presenta una clave para las ocho especies de *Meliosma* que se conocen de Bolivia.

Key words: Bolivia, *Meliosma*, Sabiaceae, South America.

Sabiaceae comprise 3 genera and about 90 species, disjunct between Southeast Asia and tropical America. *Sabia* Colebrooke is a tropical Asian genus with 19 species (Chen, 1943; Van de Water, 1980); *Ophiocaryon* Endlicher, with about 7 species, is confined exclusively to northern South America (Gentry, 1980); and *Meliosma* is a genus with ca. 15 species in Southeast Asia and ca. 50 species in the Neotropics (Gentry, 1986).

Meliosma trees are used as timber in the Neotropics, and a few Asian species are cultivated as ornamentals. The Neotropical species are distributed from Mexico and the West Indies to Brazil and Bolivia and are typically found in evergreen moist and cloud forest (Gentry, 1980). Van Beusekom (1971) stated that self pollination (not so much of individual flowers, but especially between different flowers of the same plant) possibly accounts for the local endemism of the *Meliosma* species; they are usually isolated from each other, either geographically or ecologically by altitude or habitat. In the field it is known that the fruits remain on the trees for long periods of time. It is difficult to obtain collections with flowers, and since the floral characteristics are the principal feature used to distinguish species, without them many collections are impossible to determine.

Meliosma Blume, Catalogus 10–11. 1823. TYPE: *Meliosma lanceolata* Blume (lectotype, designated by Van Beusekom, 1971: 430).

Trees and shrubs; leaves alternate to suboppposite, simple or pinnately compound, frequently clustered at the twig apices; inflorescence mostly a leafy terminal panicle, 3 or 4 times branched, without clear demarcation between twig and rachis, sometimes racemose or cymose; flowers small, essentially 5-merous and usually perfect, often in glomerules, very crowded, sessile or almost so; sepals 5, imbricate (the outer 2 may be ± reduced, similar to a bracteole), glabrous or fimbriate on the outside; petals 5, 3 outer ones large and 2 inner ones ± reduced; fertile stamens 2 (5 in *M. herbertii*), attached at base to the inner petals, anthers 2-locular, the thecae short and thick, transversely dehiscent, often separated by the thickened connective, the staminodes 3, forming a cap over the pistil; ovary ovoid to conical or complanate, 2-locular, 2 ovules/locule, style usually bifid or simple, disc surrounding the ovary, usually with 5 teeth, 4 of them paired (each pair coinciding with the inner petal base position) and one solitary; fruit drupaceous, globose to obovoid and single-seeded, exocarp fleshy, endocarp woody and sculptured; seeds with little or no endosperm.

The genus *Meliosma* has been divided as follows by Van Beusekom (1971), mostly based upon endocarp characteristics and also flower and leaf characters:

Meliosma subg. **Kingsboroughia** (Liebmann) Beusekom
sect. *Hendersonia* Beusekom → Southeast Asia (1 sp.)
sect. *Kingsboroughia* → Southeast Asia (2 spp.)

Meliosma subg. **Meliosma**
sect. *Meliosma* → Southeast Asia (12 spp.)
sect. *Lorenzanea* (Liebmann) Beusekom → Neotropics (ca. 50 spp.)

Fifteen species were recognized by Van Beusekom (1971) in the revision of the Southeast Asian sections of *Meliosma*. Section *Lorenzanea* is restricted to the Neotropics and has never been monographed. All but one of the New World species, *M. alba* (Schlechtendal) Walpers of Mexico, belong to subgenus *Kingsboroughia*. *Meliosma alba* also occurs in south-central China, and it is the only New World species of the genus with compound leaves. A few revisions of the genus in some countries exist, e.g., *Flora de Colombia* (Cuatrecasas & Idrobo, 1955) and *Flora of Panama* (Gentry, 1980).

Ruíz de Centurión (1993) reported five species of *Meliosma* in Bolivia, two of them undetermined. The two undetermined species correspond to *M. frondosa* Cuatrecasas & Idrobo and *M. solomonii* A. H. Gentry, respectively, for a total of three species instead of five. The present study recognizes eight species. *Meliosma glabrata* (Liebmann) Urban and *M. herbertii* Rolfe (the more common species in Bolivia) are found only below 1000 m elevation in humid montane forest with some kind of disturbance or in occasionally inundated forest. Four species, *M. boliviensis* Cuatrecasas, *M. frondosa*, *M. solomonii*, and *M. wurdackii* Cuatrecasas, show a great elevational range, being found from 100 to above 3000 m, in cloud forest and Amazonian forest. The two new species described here, *M. minutipetala* and *M. petalodentata*, are known from the departments of La Paz and Cochabamba, at elevations between 2200 and 2800 m, in moist montane (yungas) forest with some disturbance.

KEY TO THE SPECIES OF *MELIOSMA* FROM BOLIVIA BASED ON FLOWERING MATERIAL

1a. Inner petals bifid.
  2a. Outer petals with dentate-fimbriate margin; filament 1.4–1.6 mm long . . . . . *M. petalodentata* Arbeláez
  2b. Outer petals with entire margin; filament ca. 1 mm long.
    3a. Inner petals less than 1 mm long; leaves irregularly arranged and clustered, 5–20 cm long, 1–4 cm wide, coriaceous . . . . . *M. solomonii* A. H. Gentry
    3b. Inner petals 1–1.2 mm long; leaves alternate, 25–30 cm long, 10–13 cm wide, chartaceo-membranaceous . . . . . *M. wurdackii* Cuatrecasas
1b. Inner petals entire.
  4a. Inner petals shorter than or equal to filament, adnate completely to filament.
    5a. Inner petals transversely oblong, ca. 0.2 mm long, about half the filament length, apex truncate-retuse to somewhat rounded . . . . . *M. minutipetala* Arbeláez
    5b. Inner petals ovate, ca. 0.5 mm long, ± equal to filament length, apex obtuse . . . . . *M. frondosa* Cuatrecasas & Idrobo
  4b. Inner petals longer than the filament, only basally adnate to the filament.
    6a. Inner petal linear, ca. 2 mm long, twice the length of the filament . . . . . *M. glabrata* (Liebmann) Urban
    6b. Inner petal spatulate or orbicular-obovoid, 0.5–1.5 mm long, its length closest to that of the filament.
      7a. Inner petal spatulate; the 2 segments of the stigma not divergent; outer petals with minutely dentate margins; 2 fertile stamens per flower . . . . . *M. boliviensis* Cuatrecasas
      7b. Inner petal orbicular-obovoid; the 2 segments of the stigma divergent; outer petals with entire margins; 5 fertile stamens per flower . . . . . *M. herbertii* Rolfe

Meliosma minutipetala Arbeláez, sp. nov. TYPE: Bolivia. La Paz: Murillo, valle del Río Zongo, 32.1 km al N de la cumbre, cerca de la boca del Río Jachcha Cruz, 2200 m, 14 Feb. 1988, 16°07′S, 68°04′W, *J. C. Solomon 17833* (holotype, MO; isotype, LPB). Figure 1.

Arbor circa 4 m alta. Lamina obovata, 23.5–31 cm longa et 9.3–12 cm lata, glabra. Inflorescentia sparsim puberula; flores sepalis (1.05–)1.2–1.3 (1.45) mm diametris, petalis interioribus 0.20–0.24 mm longis et 0.24–0.36 mm latis.

Tree 4 m tall; branchlets rounded, surface grayish, longitudinally very finely ridged with large raised scattered lenticels, mostly glabrous, with few and inconspicuous reddish trichomes. Lamina obovate, 23.5–31 cm long, 9.3–12 cm wide, apex broadly cuneate to rounded, sometimes slightly apiculate, base cuneate, rather coriaceous, margins entire, the main vein strongly impressed above, strongly raised below, secondary veins slightly impressed above, strongly raised below, both sides mostly glabrous, abundant golden reddish trichomes present along the midvein below when young, persistent at base of the secondary venation abaxially at maturity; petiole 3–6 cm long, with small scattered lenticels. Inflorescence terminal, and from the upper foliate axils, paniculate, ca. 35 cm long, rachis straight, grayish and strongly lenticellate, sparsely puberulous, lateral branches to 12, completely covered by golden trichomes, lenticellate; pedicels to 0.5 mm long. Flowers seen only in bud; sepals 5, orbicular, (1.05–)1.2–1.3(1.45) mm diam., margins long fimbriate, two

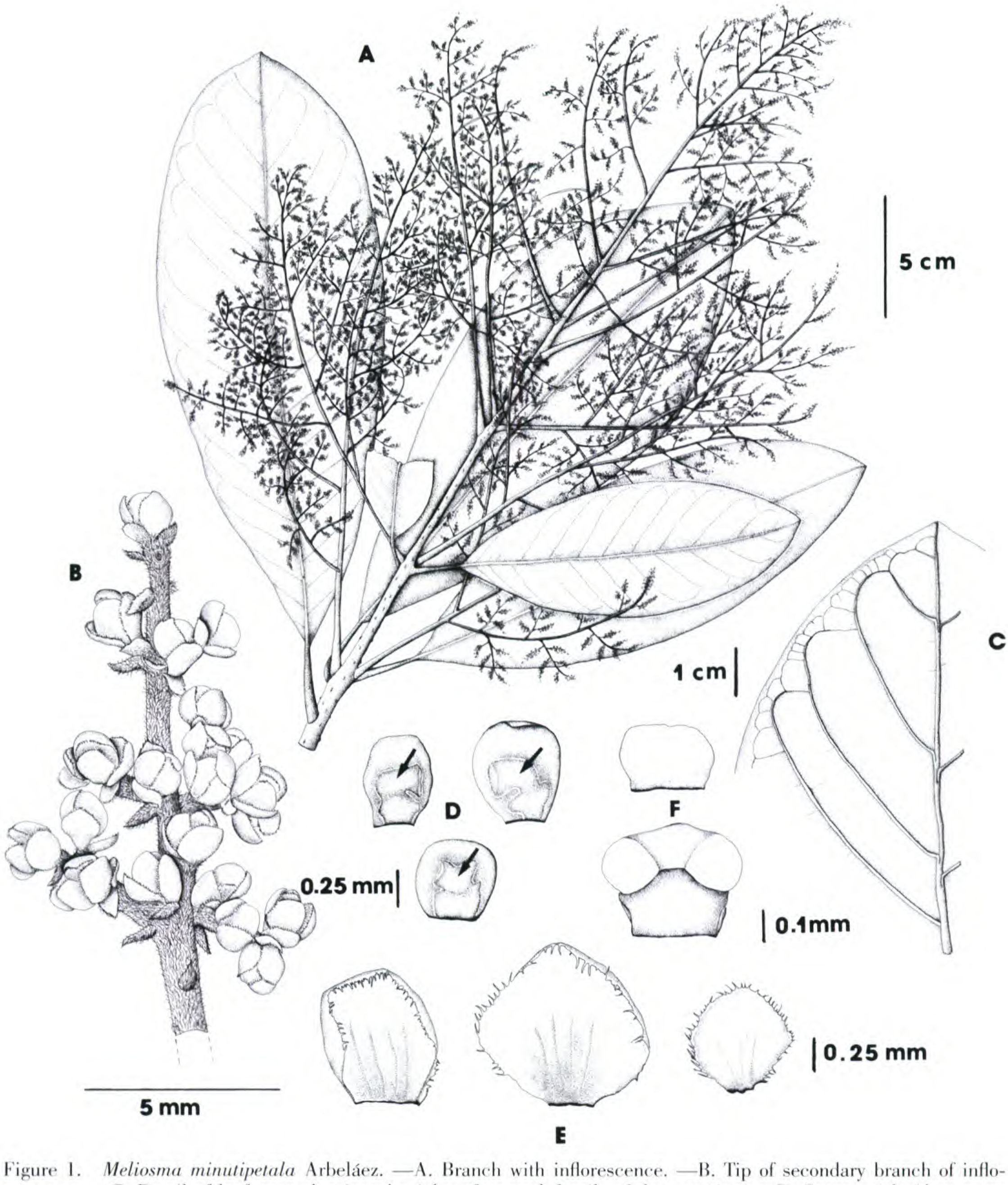

Figure 1. *Meliosma minutipetala* Arbeláez. —A. Branch with inflorescence. —B. Tip of secondary branch of inflorescence. —C. Detail of leaf apex showing abaxial surface and details of the venation. —D. Outer petals (the arrows showing the staminodes). —E. Sepals. —F. Fertile stamen and inner petal. (Illustrations from *J. C. Solomon 17833.*)

outer ones fimbriate on the outside surface; petals 5, glabrous, outer petals 3, ovate to obovate, the outermost 0.7–1 mm long, 0.6–0.7 mm wide, internal two 0.52–0.63 mm diam., inner petals 2, transversely oblong, 0.20–0.24 mm long, 0.24–0.36 mm wide, truncate-retuse to somewhat rounded at apex; fertile stamens 2, thecae suborbicular, each 0.18–0.26 mm long, separated by thickened connective tissue, including connective tissue 0.42–0.58 mm across, the filament 0.24–0.4 mm long, 0.28–0.4 mm wide, completely adnate to the inner petal; pistil ca. 0.4 mm long, glabrous, ovary complanate. Fruits not known.

Distribution. This species is only known from the type specimen, collected at 2200 m elevation in humid forest north of La Paz.

Meliosma minutipetala is close to *M. frondosa*,

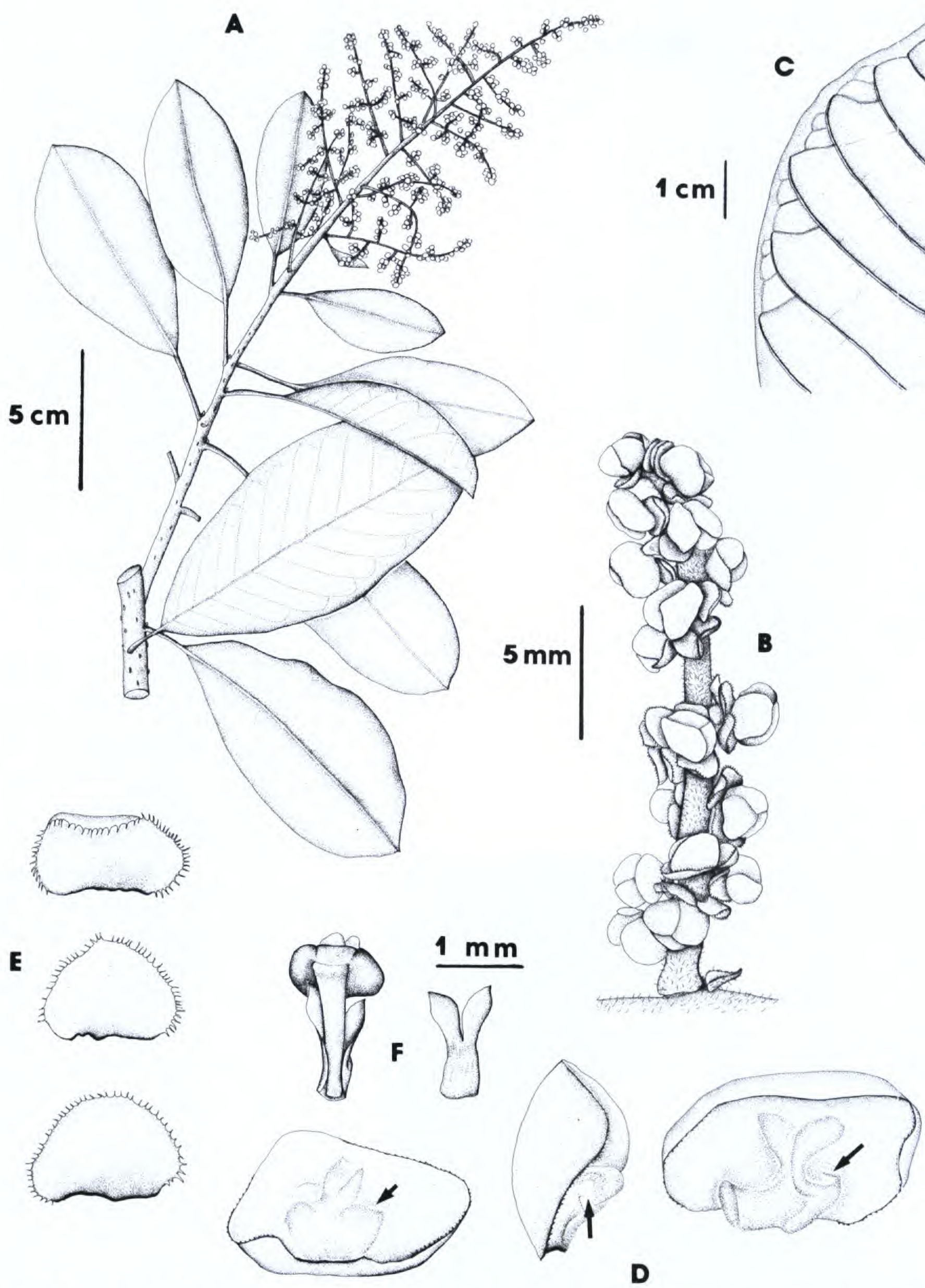

Figure 2. *Meliosma petalodentata* Arbeláez. —A. Branch with inflorescence. —B. Secondary branch of inflorescence. —C. Detail of leaf apex showing abaxial surface and details of the venation. —D. Outer petals (the arrows showing the staminodes). —E. sepals. —F. Fertile stamen (+ inner petal) and inner petal. (Illustrations from *J. C. Solomon 8964*.)

both species having sepals much larger than the outer petals, and the sepals completely enclosing the rest of the flower. *Meliosma frondosa* differs from *M. minutipetala* by having the secondary branches of the inflorescence somewhat crowded together at the base (vs. secondary branches spread out), the inner petals ovate and as long as the filament (vs. transversely oblong and about half the length of the filament), the leaves rounded at base and apex (vs. broadly cuneate to rounded at the apex, sometimes slightly apiculate, cuneate at the base).

Meliosma minutipetala is a distinctive species, having by far the smallest inner petals (to 0.24 mm long, as seen in bud) of those that have been previously reported for any *Meliosma* species in the Neotropics (e.g., *M. frondosa*, to which it is closely related, and *M. simiarum* A. H. Gentry, from northern Peru). The minute inner petals of *M. minuti-*

petala easily separate this species from the other Neotropical species of *Meliosma*.

Meliosma petalodentata Arbeláez, sp. nov. TYPE: Bolivia. La Paz: Murillo, 27 km N (below) of dam at Lago Zongo, 2500 m, 27–28 Nov. 1982, 16°08′S, 68°06′W, *J. C. Solomon 8964* (holotype, MO). Figure 2.

Arbor circa 8 m alta. Lamina elliptica, 28 cm longa et 11.5 cm lata, pagina superiore glabra, pagina inferiore glanduloso-punctata et/vel trichomatibus praedita. Inflorescentia sparsim glanduloso-punctata et/vel trichomatibus praedita; flores sepalis 1.4–1.8 mm longis et 1.6–2 mm latis, petalis interioribus bifidis, 1.2–1.5 cm longis, 0.9–1.4 cm latis.

Tree ca. 8 m tall; branchlets somewhat angled to subterete, surface brownish, longitudinally finely ridged with raised scattered lenticels, with few minute and inconspicuous ascending reddish trichomes. Lamina elliptical, 5.5–28 × 2.5–11.5 cm, apex broadly cuneate to slightly rounded, base mostly cuneate, rather coriaceous, margins entire, the midvein strongly impressed above, strongly raised below, secondary veins plane above, raised below, mostly glabrous above except for glandular-punctuate and/or few reddish trichomes on the mid and secondary veins, glandular-punctate and/or abundant reddish trichomes covering all the surface below; petiole 1.6–3.5 cm long, with at most a few tiny lenticels. Inflorescence terminal, paniculate, 13–25 cm long, rachis straight, brownish and strongly lenticellate, with reddish ascending trichomes and/or glandular-punctate on the surface, lateral branches to 12, completely covered by trichomes, lenticellate; pedicels to 1 mm long. Flowers white; sepals 5, orbicular, 1.4–1.8 mm long, 1.6–2 mm wide, the margins long fimbriate, two outer ones long fimbriate on the outside surface; petals 5, glabrous, outer petals 3, oblate, 1.8–3 mm long, 2–3.7 mm wide (outermost largest), margins dentate-short fimbriate, inner petals 2, bifid, 1.2–1.5 mm long, 0.9–1.4 mm wide, each segment acute, margins distally minute-dentate; fertile stamens 2, thecae suborbicular, each ca. 0.6 mm long, slightly separated by connective tissue, including connective tissue 1.2–1.3 mm across, the filament 1.4–1.6 mm long, 0.3–0.4 mm wide, attached to about ⅓ of the inner petal length; pistil ca. 1.2 mm long, glabrous, ovary ovoid. Fruit not known.

Distribution. The species was first collected by Steinbach more than 70 years ago. It is apparently endemic to the montane humid forest of west-central Bolivia in Murillo and Chapare Provinces.

Meliosma petalodentata somewhat resembles *M. solomonii*. *Meliosma petalodentata* is characterized by petals (outer and inner) with crenate-dentate margins (vs. entire margin), the outer petals usually more than 3 mm wide (vs. ca. 2 mm), the filament more than 1 mm long (vs. to 1 mm long). The collection [Bolivia. La Paz: Nor Yungas, 72 km hacia Coroico (500 m después de La Cumbre), 3050–3150 m, 16°15′S, 67°20′W, *Beck 1836* (MO)] identified as *M. frondosa* is a mixed collection.

Most species within the genus have both petals with entire margins; however, sometimes species such as *M. occidentalis* Cuatrecasas (Costa Rica to Ecuador) and *M. grandiflora* C. V. Morton ex A. H. Gentry (Costa Rica and Panama) have the outer petals with limited dentate margins. The characteristic of having both outer and inner petals dentate separates this species from all other Neotropical *Meliosma* species.

Paratype. BOLIVIA. **Cochabamba:** Chapare, Wald Aduana-Incachaca, 2800 m, 10 Mar. 1929, 17°20′S, 65°45′W, *Steinbach 9593* (MO, US).

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New Species of *Alstroemeria* (Alstroemeriaceae) from the Brazilian Savannas

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ABSTRACT. Two new species of *Alstroemeria* (Alstroemeriaceae) from the Brazilian savannas are described: *A. stenophylla* M. C. Assis, which is characterized by its narrow linear-lanceolate leaves, concentrated on the distal region of the vegetative stem, and for its ruby-spotted inner tepals, close to *A. gardneri* Baker and *A. plantaginea* Martius ex Schultes & Schultes f.; and *A. tombolatoana* M. C. Assis, which may be recognized by its coriaceous leaves, outer tepals oblong-spatulate, without patterning, but the inner tepals spatulate and ruby-maculate, sympatric with *A. gardneri*. Descriptions, comments, and illustrations are presented.

Key words: *Alstroemeria*, Alstroemeriaceae, Brazil, savannas.

Alstroemeria L. is represented by around 90 species widespread in South America, ranging from Venezuela (3° North) to Tierra del Fuego, Argentina (53° South), with two main centers of distribution, one in Chile (extending into Peru, Bolivia, and Argentina) and the second throughout Brazil, Paraguay, and Argentina (Bayer, 1987; Aker & Healy, 1990). In Brazil the genus comprises 38 species distributed in the eastern regions of the country. These species occur in different habitats: forest, savanna, high fields, marsh, "campos rupestres," and "caatinga," from a height of 300 m above sea level in the Amazon up to 2300 m above sea level at Serra do Itatiaia. Most species have a restricted distribution (Assis, 2001, 2002). The recent taxonomic revisions of the group for Brazil (Assis, 2001), Argentina (Sanso, 1996), and Chile (Bayer, 1987) have improved the basic knowledge of the genus.

The genus comprises perennial herbs with fleshy root-tubers and rhizomes bearing separate vegetative and reproductive stems. The leaves are resupinate, the flowers usually zygomorphic and patterned, and the fruit is a 3-valved loculicidal capsule.

During a recent revision of *Alstroemeria* from Brazil, two distinctive new species were discovered in savannas. These species are here described.

Alstroemeria stenophylla M. C. Assis, sp. nov. TYPE: Brazil. Goiás: Cocalzinho, Estrada de acesso aos Pirineus, próximo aos Três Picos, 28 May 1998 (fl), *M. C. Assis, R. C. Forzza & A. F. C. Tombolato 560* (holotype, SPF; isotypes, CEN, MO). Figure 1A–D.

Herba foliis coriaceis, glabris, lineari-lanceolatis, in tertia parte distali rami vegetativi congestis et floribus tepalis internis rubro-punctatis.

Perennial herb 0.2–0.7 m tall; stems cylindrical, glabrous. Leaves of the vegetative stem 1.5–15 × 0.3–0.5 cm, resupinate, chartaceous, concentrated toward the apex, linear-lanceolate, apex acuminate, base truncate, both faces glabrous with prominent veins; leaves of the reproductive stem 0.8–4.5 × 0.2–0.3 cm, resupinate or not, coriaceous, distributed along the stem, linear-lanceolate, apex acuminate, base truncate, both faces glabrous with prominent veins. Inflorescence an umbel-like simple cyme of 3 to 5 flowers; pedicel glabrous, 1–4 cm long; bracts leaf-like, chartaceous, 0.6–2 × 0.1 cm. Flower patent, campanulate, red or orange, 2–3.8 cm long. Tepals 6 in 2 whorls; outer tepals not patterned, narrowly obovate or oblanceolate, apex apiculate, base attenuate; the upper ca. 3 × 0.9 cm; the lower ones ca. 2.7 × 0.9 cm; inner tepals ruby-spotted, all three very similar, narrowly elliptic-spatulate, apex acuminate, base attenuate; the upper tepals ca. 3 × 0.8 cm; the lower one ca. 2.5 × 0.7 cm. Stamens 6, included, filaments papillate at base, ca. 1.5 cm long; stigma included, style glabrous, about 1 cm long. Capsule ovoid, 0.9–1.2 × 0.8–1.2 cm.

Distribution and phenology. *Alstroemeria stenophylla* is found on the rocky outcrops and on riverine forest borders in the states of Goiás and Minas Gerais in Brazil. Flowers: March and May. Fruit: May.

Alstroemeria stenophylla is characterized by its narrow linear-lanceolate leaves concentrated on the

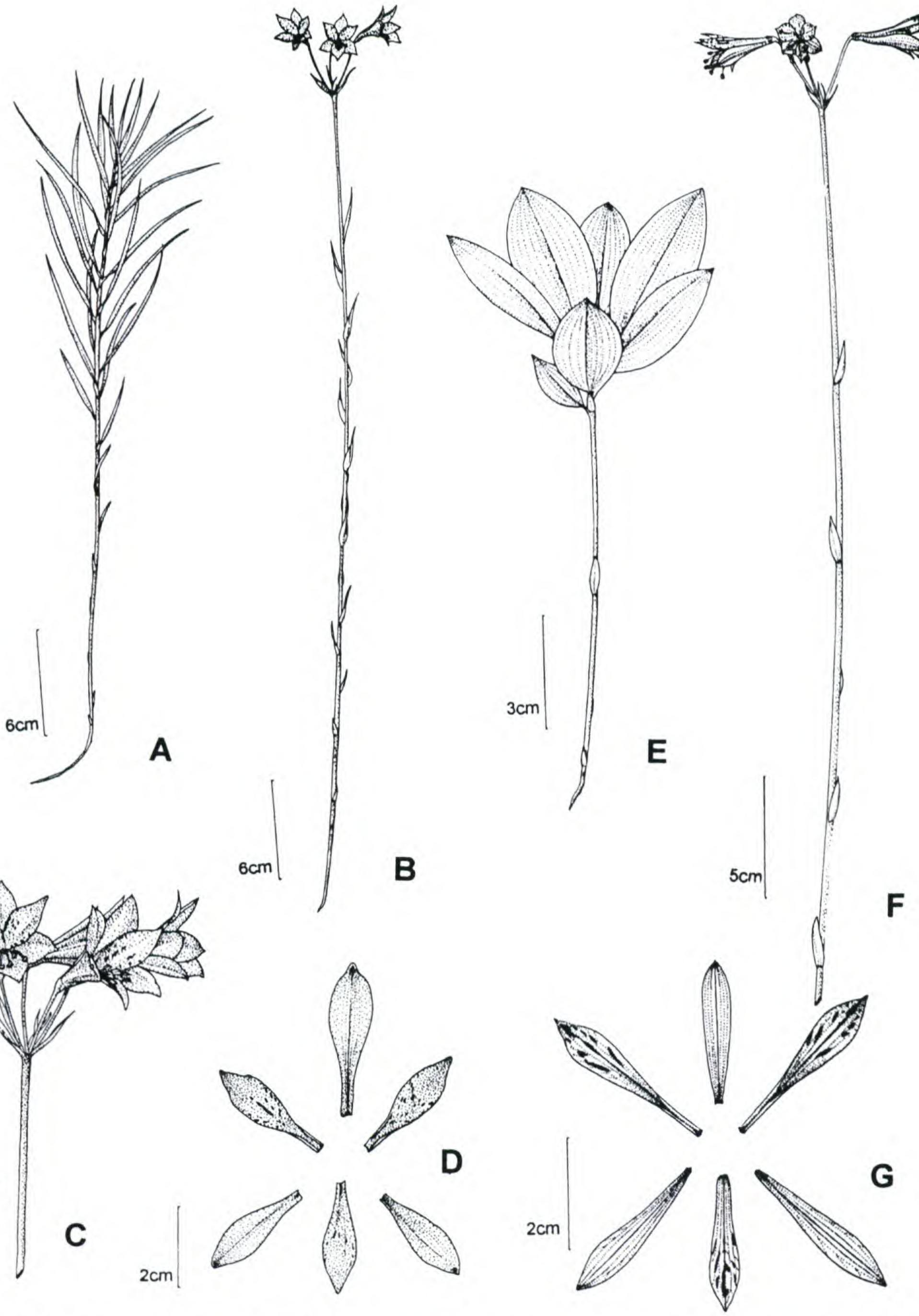

Figure 1. A–D. *Alstroemeria stenophylla* M. C. Assis. —A. Vegetative stem. —B. Reproductive stem. —C. Inflorescence. —D. Tepals, the inner ones spotted. E–G. *Alstroemeria tombolatoana* M. C. Assis. —E. Vegetative stem. —F. Reproductive stem showing reduced leaves and bracts. —G. Tepals, the inner ones maculate. (A–D from the holotype, *Assis et al. 560* (SPF), E–G from *Cavalcanti 2226* (SPF).) Drawn by Eduardo H. P. Kickhöfel.

distal region of the vegetative stem and by its ruby-spotted inner tepals. The epithet is derived from the morphology of the leaves.

The flower is similar to that of the sympatric *Alstroemeria gardneri*, which is differentiated by its coriaceous elliptical or obovate leaves, distributed along the vegetative stem. The vegetative stem of the new species is similar to that of *A. plantaginea* Martius ex Schultes & Schultes f., but in this latter species the leaves are elliptical or oblong and the inner tepals are ruby-maculate.

Paratypes. BRAZIL. **Goiás:** Corumbá de Goiás, Mon-

tes Pirineus, 26 May 1968 (fl), *E. Onishi et al. 81* (IAN, UB); Serra dos Pirineus, 1300 m, 14 May 1973 (fl), *W. R. Anderson 10230* (RB, UB); Alto da Serra dos Pirineus, na base dos Três Picos, 13 Mar. 1971 (fl), *J. A. Rizzo 6035* (UFG).

Alstroemeria tombolatoana M. C. Assis, sp. nov. TYPE: Brazil. Goiás: Teresina de Goiás, 47°30′S, 13°46′W, 21 May 1994 (fl), *C. Munhoz, C. Proença, B. M. T. Walter & M. A. Silva 100* (holotype, UB; isotype, GUA). Figure 1E–G.

Herba foliis ramorum reproductivorum non resupinatis, coriaceis, lanceolatis, glabris; tepala externa sine maculis et interna rubro-maculata.

Perennial herb 0.65–0.80 m tall; stems cylindrical, glabrous. Leaves of the vegetative stem 2–5 × 0.8–2.5 cm, resupinate, coriaceous, sessile, concentrated at the apex or distributed along the stem, widely elliptic, oblong or obovate, apex acute, base attenuate, both faces glabrous with prominent veins; leaves of the reproductive stem 1–1.2 × 0.3–0.5 cm, not resupinate, chartaceous, sessile, distributed only in the upper half of the stem, lanceolate, apex acuminate, base cuneate, both faces glabrous. Inflorescence an umbel-like simple cyme of 2 to 4 flowers; pedicel glabrous, ca. 3 cm long; bracts leaf-like, chartaceous, 0.5–1.2 × 0.1–0.2 cm. Flowers patent, campanulate, reddish, 3.5–3.8 cm long; outer tepals not patterned, these three similar, oblong-spatulate, apex acute or acuminate, base attenuate; upper one 2.3 × 0.6 cm; lower two 3.1 × 0.5 cm; inner tepals ruby-maculate, these three similar, spatulate, apex apiculate, base attenuate, distal margin entire; upper two 3.3 × 0.6 cm; lower one 2.8 × 0.4 cm; stamens included, filaments glabrous, ca. 2.3 cm long; stigma included, style glabrous, ca. 2 cm long. Fruit not seen.

Distribution and phenology. *Alstroemeria tombolatoana* is rarely found in the savannas of the states of Tocantins, Goiás, and Mato Grosso. Flowers: April and June.

Alstroemeria tombolatoana may be recognized by its coriaceous leaves, outer tepals oblong-spatulate, without patterning, but the inner tepals spatulate and ruby-maculate. This species is sympatric with *A. gardneri*, which has elliptical to rounded-spatulate outer tepals and elliptical-spatulate ruby-spotted inner tepals.

The epithet of the new species, *tombolatoana*, is in honor of Antonio Fernando Caetano Tombolato, a researcher at the Agronomic Institute of Campinas in São Paulo State (Brazil), who stimulated and assisted me in the beginning of my work with data gathered during several years of research with *Alstroemeria*.

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Two New Species of *Aegiphila* (Verbenaceae) from Venezuela and Brazil

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ABSTRACT. Two new species, *Aegiphila aracaensis* from Brazil and *A. hystricina* from Venezuela, are described and illustrated, and their relationships with allied species are discussed. *Aegiphila aracaensis* shares morphological similarities with *A. venezuelensis* Moldenke, although it differs in leaf shape, length, and width, and in the corolla tube externally covered by a denser canescent indument. *Aegiphila hystricina* is a shrub to small tree distinguished by its congested elongate inflorescences, and the flowers subtended by three bracteoles covered by glandular trichomes, 8- to 10-septate. The species is related to *Aegiphila arcta* Moldenke, but differs from it in leaf shape, length, and width, petiolate leaves, and larger glandular trichomes.

Key words: *Aegiphila*, Brazil, Venezuelan Guayana, Verbenaceae.

Aegiphila Jacquin is a genus of Verbenaceae with over 130 species, ranging from southern Mexico to northern Argentina (Moldenke, 1934; Jansen-Jacobs, 1988), but being most diverse and widespread in the American tropics. The genus can be distinguished from the other Neotropical Verbenaceae by the following features: inflorescences as thyrses, cymes, or panicles, flowers heterostylous, calyx and corolla 4(or 5)-lobed and stamens 4(5), without staminodes. When examining *Aegiphila* specimens in preparation of the Verbenaceae treatment for the *Flora of the Venezuelan Guayana*, we noticed several specimens of *Aegiphila* that could not be placed with any known species in the genus. Further examination showed these to be new taxa, which are described below as new species.

Aegiphila aracaensis Aymard & Cuello, sp. nov. TYPE: Brazil. Amazonas: Barcelos, Rio Aracá, próximo a foz do Rio Jauari, 00°30′N, 63°30′W, 4 July 1985, *I. Cordeiro 150* (holotype, MG; isotypes, NY, US). Figure 1.

Aegiphilae venezuelensi proxima, sed recedit: foliis oblanceolatis vel obovatis, 4–9 cm longis, 3–5 cm latis, petiolis 2–4 mm longis; pedunculo florifero 1.5–3.5 cm longo; calycibus 4–5 mm longis; lobis calycis ca. 0.2 mm longis, corollis extus dense adpresse-canescentibus et lobis corollae 1–2 mm longis; staminibus 7–10 mm longis.

Shrub to 3 m tall; branches and branchlets obtusely tetragonal, densely appressed-villous, gray hairs on the younger parts, glabrescent when mature. Leaves membranous, oblanceolate or obovate, 4–9 × 3–5 cm, apex acuminate, base attenuate; margin subsinuate, mostly in the upper half, sparsely appressed-canescent on adaxial and abaxial surfaces; pubescence denser on the midrib and on secondary veins on the abaxial surface; secondary veins 7 to 9 per side; petioles 2–4 mm long, appressed-villous with gray hairs. Inflorescence axillary, peduncle 1.5–3.5 cm long, cymose, two per node toward the apex of the branchlets; rachis and pedicels densely appressed-canescent. Flowers pedicellate, pedicels slender, 5–7 mm long, bracteoles not seen, caducous; calyx 4–5 mm long, densely appressed-canescent externally, glabrous internally, the lobes 4, triangular, ca. 0.2 mm long; corolla tube 4–6 mm long, white, denser appressed-canescent externally, mostly in the upper half, glabrous internally, the lobes 4, imbricate, 1–2 mm long, the apex acute; stamens 4, inserted ca. 4 mm from the base of the tube, exserted, filaments 7–10 mm long, glabrous, anthers oblong, ca. 0.5 mm long; ovary obconical, ca. 1 mm long, glabrous, style ca. 6 mm long, glabrous, bifid, exserted, stigmas 2, ca. 1.5 mm long. Fruit not seen.

Distribution and habitat. *Aegiphila aracaensis* was found in gallery forest at the base of the Serrá do Aracá (ca. 200 m), Amazonas state, Brazil, one of the least known sandstone mountains of the Guayana Highland. The Serrá do Aracá has a high level of endemism in which isolated species would be expected, supported by unique floristic elements and vegetation types (Prance & Johnson, 1992). The vegetation is often physiognomically distinctive and usually is characterized by unusual life forms. The area harbors such genera as *Bonnetia* Martius and *Arcythaea* Martius (Bonnetiaceae), *Raveniopsis* Gleason (Rutaceae), *Tepuianthus* Maguire & Steyermark (Tepuianthaceae), *Saxofridericia* R. H.

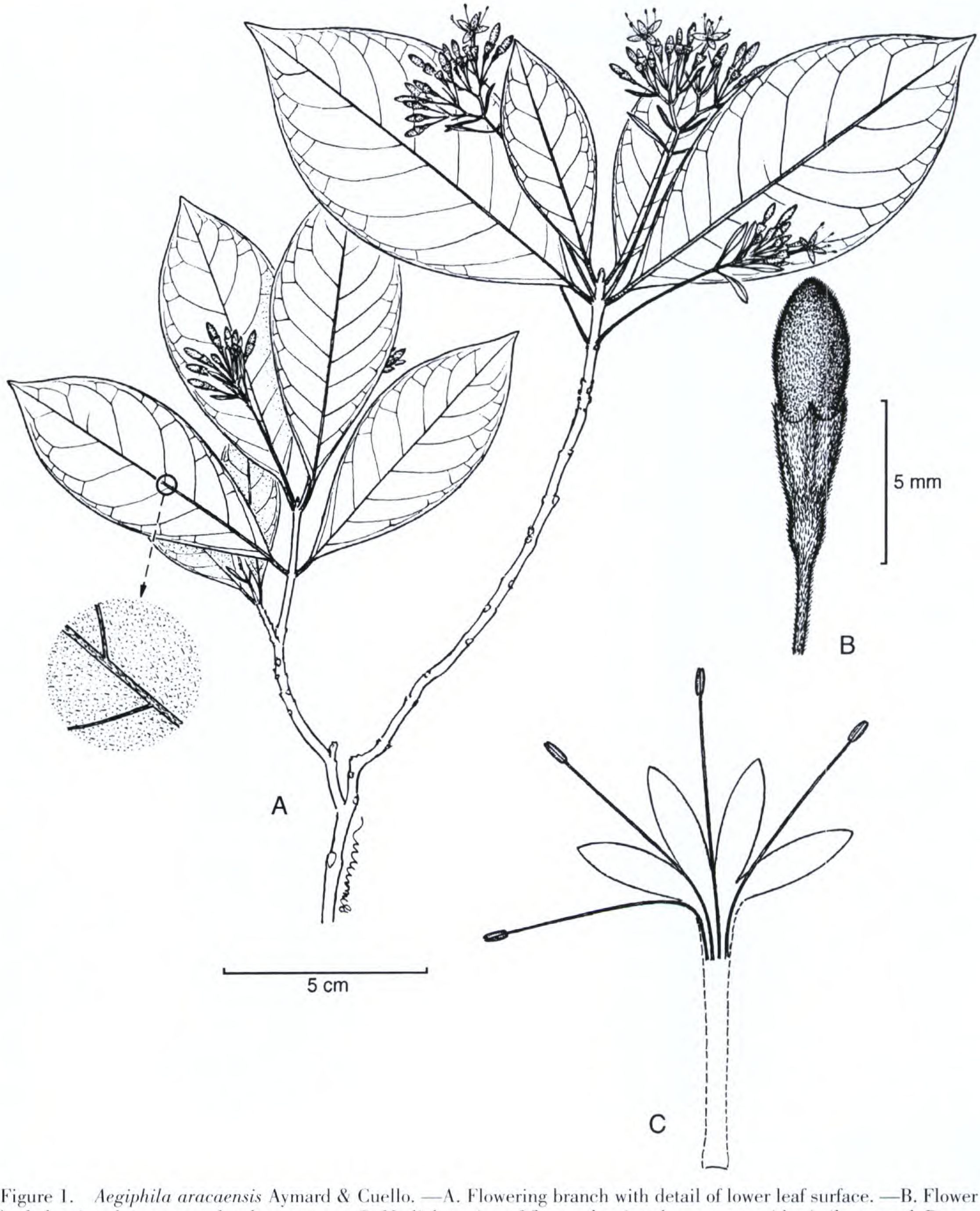

Figure 1. *Aegiphila aracaensis* Aymard & Cuello. —A. Flowering branch with detail of lower leaf surface. —B. Flower bud showing the appressed pubescence. —C. Medial section of flower showing the stamens with pistil removed. Drawn from the holotype, *Cordeiro 150* (US). Scale bar in B applies to C.

Schomburgk (Rapataceae), and *Stenopadus* Blake (Asteraceae), which are restricted to the "tepuis," or tabletop mountains in the Guayana Shield in northern South America (Berry et al., 1995). The word "tepui" is used by the Pemón Amerindians in southeastern Venezuela to designate this type of mountain. However, it is now used for all mountains with the same shape and geology found in the Guayana Shield (Huber, 1995). These mountains have been characterized as biological islands due to their shape and isolation from each other. They are formed by a layer of sandstone (the Roraima for-

Table 1. Comparison of the distinguishing character states of *Aegiphila aracaensis* and *A. venezuelensis*.

Characters	*A. aracaensis*	*A. venezuelensis*
Habitat	lowland forest (100–200 m)	medium montane to high-tepui forests (1400–2600 m)
Leaves	oblanceolate or obovate, 4–9 cm long, 3–5 cm wide	elliptic or ovate-elliptic, 9–23 cm long, 3–9 cm wide
Petiole	2–4 mm	6–15 mm
Peduncles	1.5–3.5 cm	3–6.5 cm
Calyx	4–5 mm long; lobes ca. 0.2 mm long	6–8 mm long; lobes ca. 2–2.5 mm long
Corolla	densely appressed-canescent externally; lobes 1–2 mm long	glabrous externally; lobes ca. 4 mm long
Stamens	7–10 mm long	2–4 mm long

mation) that lies over an igneous base dated at ca. 3.5 billion y B.P. (Huber, 1994; Michelangeli, 2000).

Relationships. Because of its four stamens and four corolla lobes, and the inflorescence axillary and cymose, *Aegiphila aracaensis* belongs to section *Aegiphila*, group Cymosae (Moldenke, 1934). The inflorescence and calyx externally covered by a canescent indument related it to *A. duckei* Moldenke and *A. venezuelensis* Moldenke. However, this new species is most closely allied with *A. venezuelensis*, a species endemic to the medium- to high-elevation tepui forests (1400–2600 m) in the Guayana shield in Venezuela (Moldenke, 1953; López-Palacios, 1977) and can be distinguished from the latter by the characters indicated in Table 1.

Aegiphila hystricina Aymard & Cuello, sp. nov. TYPE: Venezuela. Bolívar: La Gran Sabana, ca. 2 km NW of Kamarata valley, along a savannah river, 450 m, 22 Feb. 1967, *T. Koyama & G. Agostini 7254* (holotype, VEN; isotype, NY). Figure 2.

Aegiphilae arctae affinis, sed foliis ellipticis vel ovato-ellipticis, 8–13 cm longis, 3–6 cm latis; marginibus dense ciliatis, ambabus paginis glanduloso-villosis, pilis glandulosis ca. 2 mm longis, 8–9 septatis, petiolis 4–5 mm longis et bracteolis pilis 1.5–2 mm longis, 8–10 septatis obtectis differt.

Shrub or small tree to 6 m tall; branches and

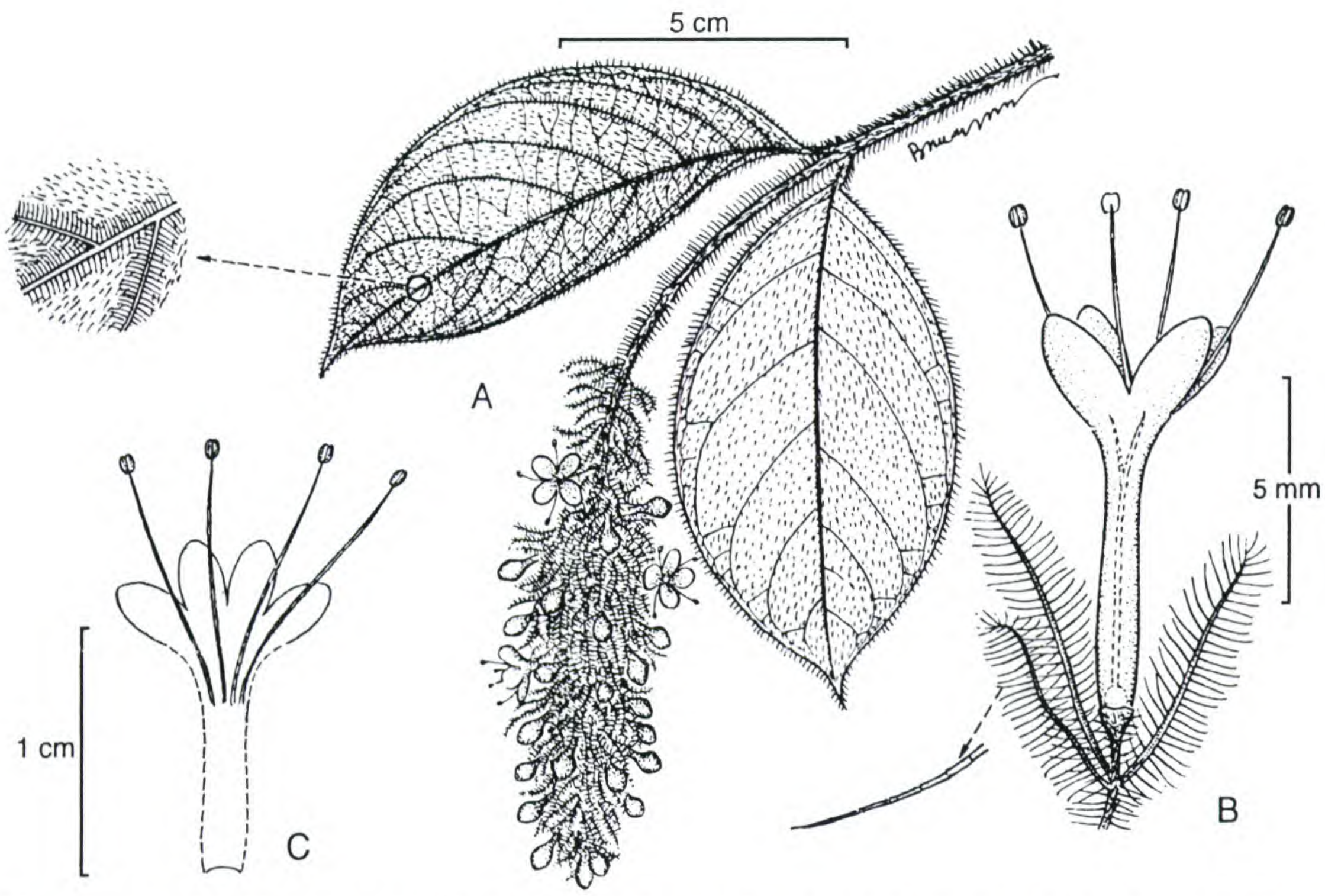

Figure 2. *Aegiphila hystricina* Aymard & Cuello. —A. Flowering branch with detail of lower leaf surface. —B. Flower subtended by the three bracteoles covered by the longer trichomes, ovary, pistil, and stigma represented by dotted lines. —C. Medial section of flower showing the stamens with pistil removed. Drawn from the holotype, *Koyama & Agostini 7254* (VEN).

Table 2. Comparison of the distinguishing character states of *Aegiphila hystricina* and *A. arcta*.

Characters	*Aegiphila hystricina*	*Aegiphila arcta*
Branches, branchlets, and peduncles	yellow-gray pubescent	brown pubescent
Leaves	elliptic or ovate-elliptic, 8–13 cm long, 3–6 cm wide, glandulose villose on both surfaces, glandulose trichomes, ca. 2 mm long, 8–9-septate, margin densely ciliate	oblanceolate or obovate, 10–18 cm long, 5–8 cm wide, sparsely glandulose villose on both surfaces, glandulose trichomes, ca. 0.4 mm long, 2–4-septate, margin sparsely ciliate
Petiole	4–5 mm	0.5–1 mm
Bracteole vestiture	trichomes 1.5–2 mm long, 8–10-septate	trichomes ca. 5 mm long, 3–4-septate
Fruit	5–6 mm long, sparsely glandular-pubescent	ca. 10 mm long, glabrescent

branchlets obtusely tetragonal, densely appressed-villous with yellow-gray hairs on the younger parts, glabrescent when mature. Leaves membranous, elliptic or ovate-elliptic, 8–13 × 3–6 cm, apex acuminate, base acute, margin entire, densely ciliate, glandular villose on adaxial and abaxial surfaces, denser on the midrib and secondary veins, glandular trichomes ca. 2 mm long, 8–9-septate; secondary veins 8 to 10 per side, elevated on the abaxial surface; petioles 4–5 mm long, densely appressed-villous with yellow-gray hairs. Inflorescence terminal thyrses, pendent, very congested, peduncle elongate, 8–11 cm long, rachis and pedicels densely appressed-villous with yellow-gray hairs. Flowers subtended by three bracteoles at the base of the pedicels, bracteoles linear, 5–10 mm long, densely covered by glandular trichomes, 1.5–2 mm long, 8–10-septate, pedicel 2–3 mm long; calyx 1–1.5 mm long, sparsely glandular pilose externally, glabrous internally, the lobes 4, ca. 0.2 mm long, triangular-ovate, ciliate-glandular, corolla tube 6–10 mm long, yellow-green, glabrous on both sides, the lobes 4, 2–4 mm long, imbricate, shortly glandular-ciliate at the margins; the stamens 4, inserted ca. 5 mm from the base of the tube, exserted, filaments 8–10 mm long, glabrous, anthers oblong, ca. 1 mm long; ovary obconical, ca. 1 mm long, glabrous, style ca. 4 mm long, inserted, glabrous, bifid, stigmas 2. Fruit globose, 5–6 mm long, appressed glandular-pubescent, mature calyx membranous and persistent, 3–4 mm long, sparsely glandular-pubescent, subtended by the three persistent bracteoles.

Distribution and habitat. *Aegiphila hystricina* is known from savanna and forest ecotone areas in Venezuela and farther southeast in the Rio Araguari, Amapá state, in Brazil. In both regions, the species occurs at elevations between 100 and 450 m.

Local names. "Huerayä daö eö" (Piaroa), from *J. Contreras 117* (VEN).

Because of its four stamens and four corolla lobes, terminal inflorescence, and calyx not deeply dentate, *Aegiphila hystricina* belongs to section *Aegiphila*, group Paniculatae, subgroup Edentatae (Moldenke, 1934; López-Palacios, 1977). The inflorescence very congested, and the linear bracteoles subtending the flowers, covered by glandulose trichomes at the base of the pedicels, places this new species next to *A. arcta* Moldenke, from Yaracuy state in the Coastal Cordillera in Venezuela (Moldenke, 1972). *Aegiphila hystricina* can be distinguished from *A. arcta* by the characters indicated in Table 2.

Herbarium specimens of *Aegiphila hystricina* were previously referred to *A. fendleri* Moldenke, a species from the mountain forests in the Andes of Colombia and Venezuela. However, the new species differs from *A. fendleri* in its leaves elliptic or ovate-elliptic and the base acute (vs. lanceolate-oblong to oblong and the base rounded or subcordate); petiole 4–5 mm long (vs. 7–12 mm long); branches, branchlets, petioles, leaves on the lower surface, and calyces covered by a yellow-gray indument (vs. all parts of the plant covered by a ferruginous indument); and inflorescences thyrses (vs. cymes).

Paratypes. VENEZUELA. **Amazonas:** Atures, alto río Carinagua, 05°45′N, 67°20′W, *J. Contreras 117* (VEN). **Bolívar:** Cedeño, Maniapure, Hato Pisurca, 06°55′N, 66°32′W, *A. Fernández 16938* (PORT). BRAZIL. **Amapá:** Rio Araguari, betw. Cachoeiras Travessao & Santa Maria, 01°09′N, 51°52′W, *J. M. Pires, W. Rodrigues & G. C. Irvine 50394* (NY).

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Senecio nemiae (Asteraceae, Senecioneae), a New Species from Sierra Grande in Patagonia (Argentina)

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ABSTRACT. A new species, *Senecio nemiae*, from Sierra Grande, Río Negro, Argentina, is described and illustrated. *Senecio nemiae* most closely resembles *S. adenotrichius* from Chile, but is clearly different by the shorter leaves without auricles and smaller capitula, with a calyculus of few bracts and length shorter than the involucre. A new status, *Senecio* sect. *Senecio* ser. *Corymbosi* subser. *Adenotrichi*, is also proposed to accommodate this taxon in the previous classification of *Senecio* for Argentina. Included is a key to those species of *Senecio* subser. *Adenotrichi* with glabrous achenes.

Key words: Argentina, Asteraceae, Compositae, Patagonia, *Senecio*, Senecioneae.

Senecio L. has been subject to diverse taxonomic interpretations varying from a single, broad genus (Barkley, 1985) to numerous segregate genera (e.g., Nordenstam, 1978; Robinson & Bretell, 1973, 1974; Jeffrey, 1992). These new taxa were established based on microfeatures such as stylar appendages, stigmatic surfaces, shape of filament collars, anther apex, anther base, and endothecial tissue (Wetter, 1983; Vincent, 1996).

In the present paper, *Senecio* is treated in its wide concept, containing about 3000 species worldwide, with the most diversity in the mountainous areas or deserts of southern South America, tropical South Africa, as well as central and eastern Asia. *Senecio* s.l. includes monoecious herbs, subshrubs, shrubs, vines, and small trees, with capitula radiate, discoid, or rarely disciform; phyllaries of equal length in one row, usually subtended by a calyculus; ray florets, if present, female with ligulate or short filiform corollas; disc florets hermaphroditic with tubular 5-dentate or 5-lobed corollas; the anthers ecaudate or slightly tailed, filament collar slender or dilated; pappus of many slender and scabrid bristles, and achenes 5- to 10-ribbed, glabrous or pubescent.

On a regional basis, a large number of species of *Senecio* has been treated by Cabrera in southern South America, i.e., 208 from Chile (Cabrera, 1949), 90 species from Brazil, Paraguay, and Uruguay (Cabrera, 1957), and 114 from Bolivia (Cabrera, 1985). In Argentina *Senecio* is represented by 266 native species, arranged in 3 sections and 16 series, with 114 species endemic to this country (Cabrera et al., 1999). Since the publication of this treatment for Argentinian species, only one new species was added (*S. calingastensis* Tombesi, 2001).

The new species described here belongs to section *Senecio*, series *Corymbosi*, which is characterized by the capitula disposed in terminal corymbs and leaves sessile, attenuate into a pseudopetiole or auriculate at the base. We include it within the subsection *Adenotrichi*, established by Cabrera (1949) for Chilean species of the genus, not cited until now for Argentina. We propose the following new status to accommodate this taxon in the classification sustained by Cabrera et al. (1999).

Senecio sect. **Senecio** ser. **Corymbosi** subser. **Adenotrichi** (Lindley) A. Bartoli, Tortosa & S. E. Freire, stat. nov. Basionym: *Adenotrichia* Lindley, Bot. Reg. 14: 1190. 1828. *Senecio* subsect. *Corymbocephalus* subsect. *Adenotrichi* (Lindley) Cabrera, Lilloa 15: 380. 1949. TYPE: *Senecio adenotrichius* DC.

The subseries *Adenotrichi* within *Senecio* appears to be closely related to series *Corymbosi* subser. *Viscosi*. Both subseries share glandular pubescence, whereas the rest of the subseries of series *Corymbosi* include species either tomentose or glabrous. Subseries *Adenotrichi* differs from subseries *Viscosi* in having deeply lobed to pinnatisect leaves (vs. entire, crenate, or serrate leaves). In addition, subseries *Viscosi* ranges from Brazil to northeastern Ar-

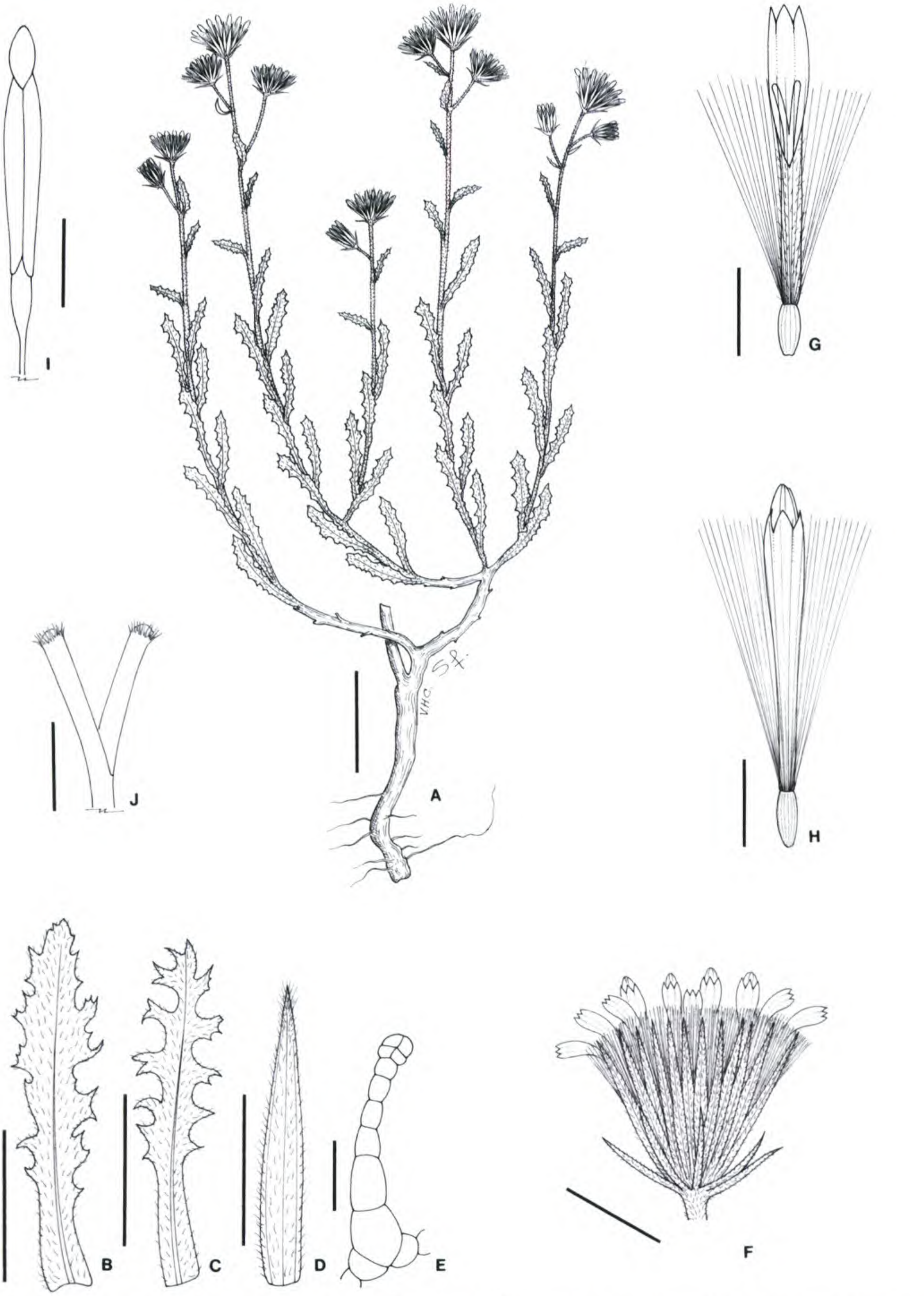

Figure 1. *Senecio nemiae* A. Bartoli, Tortosa & S. E. Freire. —A. Habit. —B, C. Leaves. —D. Phyllary. —E. Trichome. —F. Capitulum. —G. Ray floret. —H. Disk floret. —I. Anther. —J. Style branches. Scale bars: A = 3 cm; B–D = 1 cm; E = 0.1 mm; F = 5 mm; G, H = 2 mm; I, J = 1 mm. Drawn from holotype, *Correa et al. 7090* (BAB).

gentina, whereas subseries *Adenotrichi* occurs in Chile and is now reported from southern Argentina.

Senecio nemiae A. Bartoli, Tortosa & S. E. Freire, sp. nov. TYPE: Argentina. Rio Negro: San Antonio, Sierra Grande, 20 Oct. 1979, *Correa et al. 7090* (holotype, BAB). Figure 1.

Quoad formam foliorum, fabricam capitulorum et indumentum ad *Senecionem adenotrichium* accedit, sed ab ea differt capitulis, calyculo et foliis minoribus, bracteis involucri in numero minori, foliis non auriculatis et pilis capitatis brevioribus.

Shrublet 20–25 cm, much branched at the base, densely hirsute glandulose on stems, leaves, and phyllaries, with glandular capitate trichomes, mostly 0.5–0.8 mm long; stems ascending. Leaves alternate, sessile, deeply pinnatilobed, 2.5–4 × 0.4–0.6 cm, linear-elliptic, obtuse at the apex and slightly dilated at the base, margin often revolute, with midvein prominent, pubescent on both surfaces; lobes 5 or 6 at each side, irregularly dentate, acute and mucronate at the apex. Capitula 2 or 3 pedunculate, peduncles 1–2 cm long, arranged in terminal corymbs; involucre calyculate, cylindric, 8–9 × ca. 8 mm; phyllaries 28 to 30, linear ovate, 8–9 × ca. 1 mm, dorsally pubescent, apex acuminate with a tuft of short trichomes; calycular bracts ca. 9, linear, ca. 6 mm long, dorsally pubescent. Ray florets ca. 15, female, corollas yellow, ligulate, 3-dentate, ca. 6 mm long, the basal tube pilose, 2–4 mm long, the limb 3-dentate, ca. 4 mm long; disc florets ca. 50, hermaphroditic, corolla yellow, tubular, 5-lobed, ca. 7 mm long, glabrous, tube ca. 4 mm long, not basally broadened, limb narrowly campanulate, only slightly broader than the tube and not markedly distinct, throat ca. 2.2 mm long, lobes broadly triangular, ca. 0.80 mm long, at base 0.5–0.6 mm wide; anthers minutely tailed, ca. 3 mm long; filament collars balusterform, ca. 0.5 mm long; apical anther appendage ovate-lanceolate, ca. 0.4 mm long; the basal tails ca. 0.2 mm long. Style branches penicillate, ca. 1.5 mm long, apically truncate. Achenes oblong-obovate, glabrous, ca. 1.8 mm (immature length), slightly costate. Pappus bristles many, slender and scabrid, ca. 7 mm long, white.

The specific epithet honors Maevia Noemi Correa, Argentinian botanist, in recognition of her work as director of *Flora Patagónica*.

Distribution and habitat. *Senecio nemiae* is known only from Sierra Grande, in the political province Rio Negro of southern Argentina. Sierra Grande represents a mountain range of ca. 500 m altitude, at approximately 42º south latitude, and together with the Meseta de Somuncura constitutes a particular district of the vegetation of Patagonia since both regions contain a number of local endemics, e.g., *Adesmia serrana* M. N. Correa (Fabaceae), *Boopis raffaelli* Spegazzini (Calyceraceae), *Conyza magnimontana* Cabrera and *Senecio megaoreinus* Zardini (Asteraceae), and *Silene melanopotamica* var. *agrostophylla* Pedersen (Caryophyllaceae).

Senecio nemiae is closely related to *S. adenotrichius* DC. from Chile. Both species have deeply pinnatilobed leaves with dentate-acute lobes and ligulate corollas with trichomes on the tube. However, the new taxon has shorter leaves without auricles and smaller capitula with fewer phyllaries and calycular bracts.

KEY TO SPECIES WITH GLABROUS ACHENES OF *SENECIO* SECT. *SENECIO* SER. *CORYMBOSI* SUBSER. *ADENOTRICHI*

1a. Phyllaries few (ca. 13) . . *Senecio rivularis* J. Rémy
1b. Phyllaries numerous (ca. 30 to 40).
  2a. Leaves auriculate, 4–10 cm long; calyculus of many bracts as long as the phyllaries.
    3a. Leaves deeply lobed, lobes dentate-acute . . . . . *Senecio adenotrichius* DC.
    3b. Leaves lobed, lobes entire or dentate, obtuse to subacute . . . . . *Senecio murinus* Philippi
  2b. Leaves without auricles, 2.5–4 cm long; calyculus of few bracts shorter than the phyllaries . . . . . *Senecio nemiae* A. Bartoli, Tortosa & S. E. Freire

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Bulbophyllum filifolium (Orchidaceae), a New Species from Southeastern Brazil

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ABSTRACT. *Bulbophyllum filifolium*, a new orchid species from Brazil belonging to section *Xiphizusa*, is described and illustrated. The new species is rare and endemic to the municipality of Grão Mogol, Minas Gerais state, growing on rocks in campo rupestre vegetation. *Bulbophyllum filifolium* is easily recognized by its thread-like leaves, one-flowered inflorescences, and ovate petals with long club-like appendages on the margin.

Key words: Brazil, *Bulbophyllum*, Orchidaceae.

Bulbophyllum Thouars is the largest orchid genus, comprising over 1000 species throughout the tropics (Vermeulen, 1991; Dressler, 1993). The species occur mostly in the Old World, although nearly 70 species are present in the New World. Pabst and Dungs (1975, 1977) cited 54 species for Brazil, and with the addition of some recently described species and new occurrences for this country (e.g., Borba et al., 1998; Fraga, 1999; Toscano de Brito, 2000), this number is increased to about 60.

Twelve of the Brazilian *Bulbophyllum* species belong to section *Xiphizusa* (Reichenbach f.) Cogniaux, characterized mainly by the long fused sepals. Those species are mainly epiphytic in forest areas in southeastern Brazil, and occasionally lithophytic in campo rupestre vegetation, as *B. plumosum* (Barbosa Rodrigues) Cogniaux. The campo rupestre of the Espinhaço Range is the Brazilian vegetation with the highest number of endemisms and greatest diversity (Joly, 1970; Giulietti & Pirani, 1988). Due to the discontinuity of these mountain ranges and outcroppings, many species, mainly the lithophytic ones, are distributed in disjunct populations. Because of that, some sites are especially rich in the number of endemic species and/or present populations differentiated (e.g., genetically, morphologically, chemically) from the core area of the species, as in the region of Grão Mogol in the north of Minas Gerais (Giulietti & Pirani, 1988; Borba et al., 2001a, 2001b, 2002). In the course of a revision of Brazilian *Bulbophyllum* and the population genetics and reproductive biology studies of the orchids of Grão Mogol, we found a new species of *Bulbophyllum* in section *Xiphizusa* with remarkable leathery thread-like leaves, described as follows:

Bulbophyllum filifolium Borba & Smidt, sp. nov. TYPE: Brazil. Minas Gerais: Grão Mogol, Serra do Barão, 16°33′S, 42°54′W, 7 Jan. 2002 (fl), *E. L. Borba 1999 & C. van den Berg* (holotype, HUEFS). Figure 1.

Species haec *Bulbophyllo pabstii, B. bidentato, B. plumoso* et aliis speciebus sectionis *Xiphizusa* similis; ab omnis speciebus folio filiforme inflorescentia uniflora et combinatione labelli lobo medio carnoso, lobis marginibus lateralibus dense curto-ciliatis ornatis et petalis ovatis appendicibus claviformibus ornatis longioribusque ad marginem differt.

Lithophytic herbs; roots 20–40 mm long, thread-like, fasciculate; rhizome 2–8 × 1 mm, creeping; pseudobulbs 4–8 × 6–7 mm, aggregate, ovoid, slightly 3- to 4-angular, monophyllous. Leaves 25–30 mm long, 1 mm diam., thread-like, leathery, folded, erect, apex acute, base canaliculate and attenuate. Inflorescence basal, one-flowered; scape 40–50 mm long, curved, with 4 sheath-like bracts, 3–4 mm long, adpressed, not imbricate; floral bracts 4 × 3 mm, ovate-lanceolate, glabrous, apex acute; flower pendent; ovary 3 mm long, sulcate; sepals membranaceous, subequal, erect-patent, boat-shaped, glabrous; dorsal sepal 14 × 3 mm, linear-lanceolate, 3-nerved, apex acute; lateral sepals fused up to the apex, synsepal 14 × 5 mm, lanceolate, 7-nerved, apex acute, slightly gibbous at base; petals 4 × 3 mm, oblique-ovate, erect, 1-nerved, margins ciliate at the base, with club-like appendages up to 1 mm long increasing in size from base to apex; lip 9 × 1.7 mm, fleshy, erect, parallel to column, movable; lateral lobes 4 mm long, erect, auriculate, densely

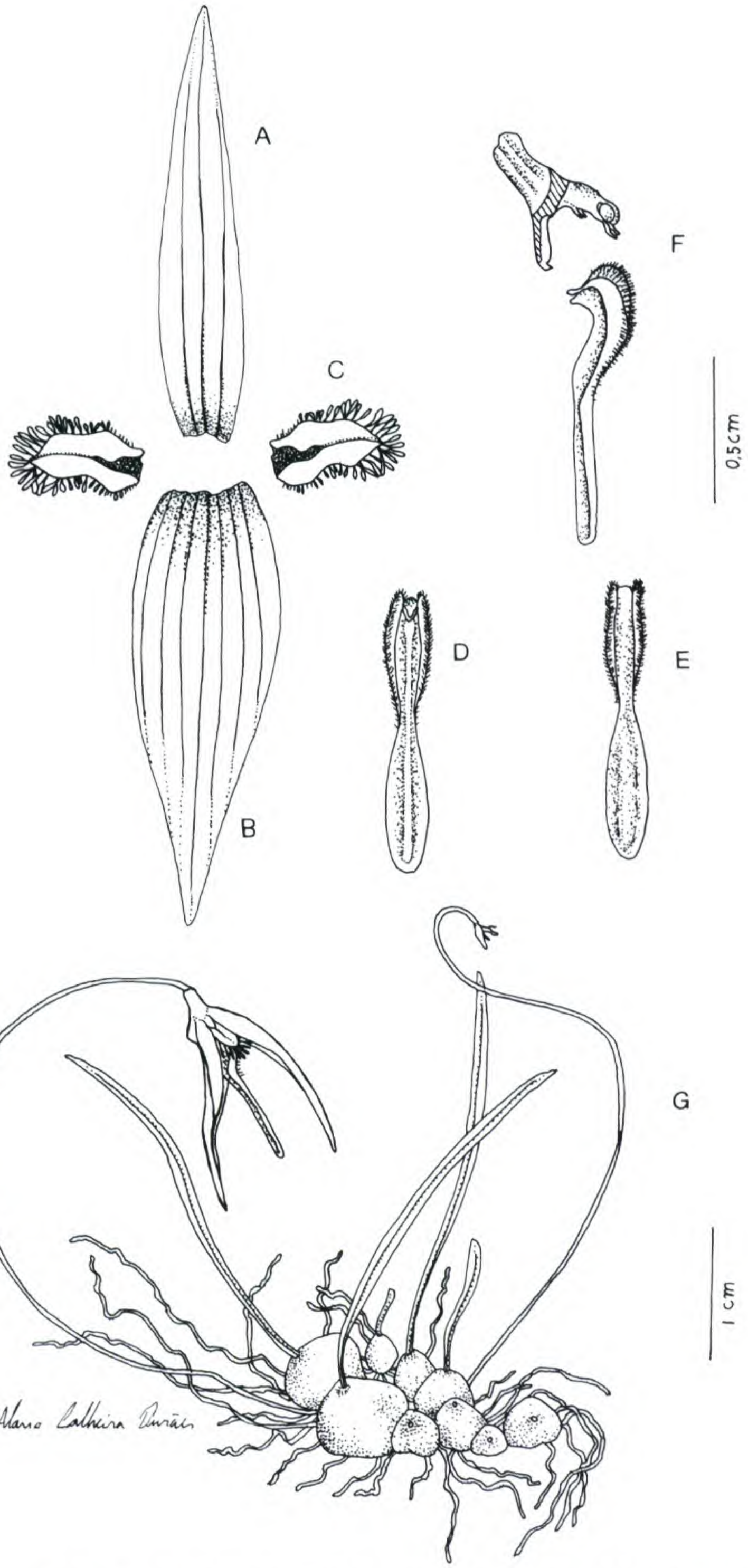

Figure 1. *Bulbophyllum filifolium* Borba & Smidt. —A. Dorsal sepal. —B. Fused lateral sepals. —C. Petal. —D. Lip, lower view. —E. Lip, upper view. —F. Lip (below) and column (above), in side view. —G. Habit. Scale bars: 0.5 cm, A–F; 1 cm, G. Drawn from the holotype, *Borba 1999 & van den Berg*, by Alano Duraes.

short-ciliate; mid-lobe 5 mm long, linear-elliptic, adaxially with one distinct longitudinally sulcate ridge, adaxial surface glabrous, apex rounded; column 3 × 1.1 mm, with two sinuate stellidia at apex and two falcate teeth on the ventral face; anther versatile, 3-globose.

Etymology. This species is named for the extremely narrow, linear (thread-like) leaves, the narrowest among the Brazilian *Bulbophyllum* species.

Distribution. *Bulbophyllum filifolium* grows on rock outcrops of quartzite in the campo rupestre vegetation of Serra do Barão, in the municipality of Grão Mogol, in the state of Minas Gerais, Brazil, a disjunct area of the main Espinhaço Range. The campo rupestre vegetation is characterized by open, herbaceous vegetation on sandy, stony soils mixed with herbs and shrubs growing on outcroppings of quartzite, sandstone, gneiss or "canga" (iron) rocks (Giulietti & Pirani, 1988; Borba et al., 2001a). This species appears to be endemic to the Grão Mogol region and is rare, as only three individuals have been found despite several field trips made to the type locality. A fragment of the same individual as the holotype is currently under cultivation at the Universidade Estadual de Feira Santana (another fragment of the same individual and the other two individuals remain undisturbed at the original locality). The Serra do Barão was recently defined as a State Reserve (Parque Estadual de Grão Mogol), and *B. filifolium* possibly occurs at other sites there. Further studies are necessary to assess the conservation status of the species.

Bulbophyllum filifolium belongs to section *Xiphizusa* as suggested by its floral and vegetative morphology, such as the erect rachis not geniculate and not thickened, lateral sepals long and connate to the apex forming a synsepal, a column with two long stellidia at the apex and two small teeth on the ventral face, and pseudobulbs aggregate and sulcate. The movable lip is a common feature in the genus and probably plays an important role in the pollination mechanism of this species (wind-assisted fly pollination; Borba & Semir, 1998), as observed in other species of section *Xiphizusa* presenting similar flower structure (e.g., *B. plumosum* (Barbosa Rodrigues) Cogniaux and *B. bidentatum* (Barbosa Rodrigues) Cogniaux; Verola, 2002). This species is easily recognizable by its thread-like leaves and one-flowered inflorescences, unique among the members of *B.* sect. *Xiphizusa*. The other two Brazilian *Bulbophyllum* species with narrow leaves are *B. insectiferum* Barbosa Rodrigues and *B. adiamantinum* Brade, belonging to sections *Bulbophyllaria* and *Micrantha*, respectively. However, conversely to *B. filifolium*, these two species have succulent cylindrical leaves and multi-flowered inflorescences with very distinct flowers; they also occur in Minas Gerais, but are not sympatric with *B. filifolium*. The long club-like appendages on the petal margins are uncommon in other species of the section, being observed only in *B. pabstii* Garay. However, *B. filifolium* has ovate petals and the mid-lobe of the lip is fleshy, whereas *B. pabstii* has ovate-lanceolate petals and the mid-lobe of the lip is membranaceous; it also differs by the oblong-lanceolate leaf (ca. 10 mm wide) and the multi-flowered inflorescence. The lip mid-lobe of *B. filifolium* is similar to that of *B. bidentatum*, but the latter differs by the petals without the club-like appendages, the lateral lobes of the lip not ciliate, the oblong-lanceolate leaves (ca. 8 mm wide), and the multi-flowered inflorescence.

Because we found only plants with old flowers we cannot describe the flower color accurately, but they appear to be entirely purple or dark red and similar to those of *B. bidentatum*.

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Paronychia revoluta, a New Species of Caryophyllaceae from Brazil

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Abstract. A new species of *Paronychia*, *P. revoluta*, from the state of Rio Grande do Sul, Brazil, is described and illustrated. This species is closely related to *P. camphorosmoides*, distinguished from it by linear-subulate leaves with a revolute margin and prominent midribs. It is also allied to *P. fasciculata*, from which it differs in the lanceolate, acuminate, fimbriate, and whitish stipules, and linear-subulate leaves.

Key words: Brazil, Caryophyllaceae, *Paronychia*.

Paronychia Miller (Caryophyllaceae) comprises about 110 species distributed among three subgenera (Chaudhri, 1968; Bittrich, 1993). This genus is characterized by the presence of stipules and bracts, very small and clustered flowers often concealed by the bracts, filiform petals, episepalous stamens, uniovulate ovary, utricle rupturing irregularly at base, globose seeds, and a curved embryo.

Although occurring mainly in the Mediterranean region, the species of *Paronychia* are widely distributed throughout the world, inhabiting warm-temperate, montane, and occasionally alpine regions. They may be found in dry stony or rocky places, calcareous soils, mountain steppes or along sea coasts and river banks.

In this paper a new *Paronychia* species, discovered during a study of Caryophyllaceae from Brazil, is described and illustrated.

Paronychia revoluta C. E. Carneiro & A. Furlan, sp. nov. TYPE: Brazil. Rio Grande do Sul: Cambará do Sul, 29 Jan. 1983, *L. P. de Queiroz & L. S. S. Faria 470* (holotype, HUEFS; isotypes, ALCB, HRCB). Figure 1.

Herba perennis caespitosa. Caulis per totam longitudinem ramificatus, puberulus. Folia sessilia, lineari-subulata, 2.5–6 mm longa, 0.3–0.4 mm lata, apice acuminata, aristata, margine revoluta, costa subtus prominente; stipulae lanceolatae, acuminatae, margine ciliato-fimbriatae. Glomeruli laterales; bracteae lanceolatae, acuminatae, floribus breviores. Flores conici, 1–1.5 alti; sepala lanceolata, mucronata, cucullata, margine ciliata; petala 0.10–0.25 mm longa; stylus in stigmata dua filiformia, inaequalia, divergentia exeuns. Fructus globosus, apice truncato dense papillosus. *Paronychiae camphorosmoidi proxima*, sed foliorum forma differt.

Perennial herbs, ca. 16–26 cm tall; stems spreading on the surface of the ground, branches ascending or erect, much branched laterally, brownish, internodes 2–10 mm long, densely puberulent. Leaves simple, opposite, sessile, 2.5–6 × 0.3–0.4 mm, linear-subulate, apparently cylindric, acuminate, awned (awn 0.3–0.6 mm long), subglabrous, margin revolute, with short stiff trichomes in the margin and on the midribs of the abaxial surface, midribs well-marked on the abaxial surface; stipules scarious, 2–2.5 mm long, lanceolate, acuminate, margin ciliate-fimbriate, base lanuginous. Flowers small in lateral or pseudo-axillary glomerules; bracts scarious, very conspicuous, slightly shorter than the flowers, 1–1.3 mm long, lanceolate, acuminate, glabrous, margin densely fimbriate; flowers conical, 1–1.5 mm long, bisexual; pedicels 0.3–0.5 mm long, glabrous; sepals 5, 0.6–1 mm long, lanceolate, slightly cucullate, mucronate (mucro ca. 0.05 mm), without a membranous margin, ciliate, 3-ribbed, sparsely puberulent; petals 5, 0.1–0.25 mm long, alternating with sepals, inserted in the perigynous ring, ca. 0.3 mm tall, filiform, hyaline, glabrous, with rounded apex; stamens 5, opposite to the sepals, alternate with petals, inserted in the membranous perigynous ring, 0.6–0.7 mm long; filaments ca. 0.4 mm long, filiform, glabrous; anthers 0.2–0.3 mm long, oblong, glabrous; ovary

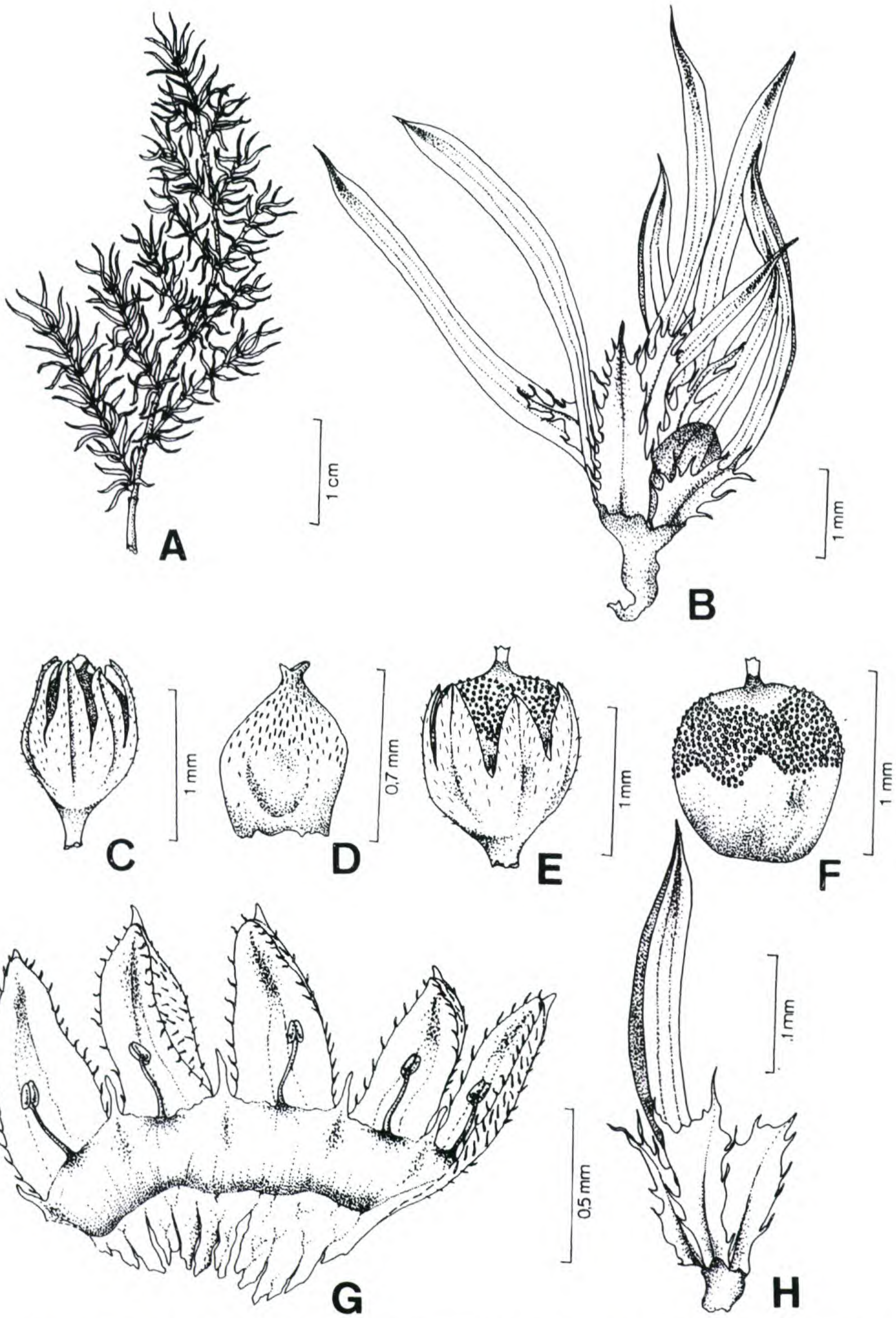

Figure 1. *Paronychia revoluta* C. E. Carneiro & A. Furlan. —A. Vegetative branch. —B. Inflorescence. —C. Flower. —D. Ovary. —E. Fruit with persistent calyx. —F. Fruit: upper part papillose. —G. Open flower: sepals, petals, and stamens. —H. Vegetative node showing stipules. (A beautiful illustration from the holotype, *Queiroz & Faria 470*, HUEFS.)

ca. 0.6 mm long, conic, membranous, papillose, uniloculate, uniovulate, with basal placentation; style ca. 0.2 mm long, bifid near apex with unequal stigmatose lobes. Fruit a utricle, membranous, enclosed in the persistent calyx, 1–1.5 mm long, globose, apex slightly truncate, densely papillose-warty on the upper part; seed ca. 0.9 × 0.8 mm, subglobose; testa smooth, bright, dark brown, sometimes reddish.

Paronychia revoluta is known only from the state of Rio Grande do Sul, Brazil, in grasslands, pastures, or slightly humid places. It was found flowering and fruiting between January and February and also in November and December.

The new species is closely related to *Paronychia camphorosmoides* Cambessèdes, which occurs throughout southeastern Brazil. The specimens analyzed were usually identified as *P. camphorosmoides*, and these two taxa were often found on the same sheet, as for example on *Rambo s.n. (PACA 53884)* and *Camargo 2620 (PACA). Paronychia revoluta* is distinguished from *P. camphorosmoides* mainly by its linear-subulate leaves with revolute margins and very conspicuous midribs, marked and semicylindric on the abaxial surface. On the contrary, *P. camphorosmoides* has lanceolate leaves with slightly thickened margins, and inconspicuous midribs. *Paronychia revoluta* also resembles the endemic to Minas Gerais, *P. fasciculata*, in the similar habit, but differs in having whitish stipules, 2–2.5 mm long, lanceolate, acuminate, with ciliate-fimbriate margins and the base lanuginous, and linear-subulate leaves with awned apices; in contrast, *P. fasciculata* has reddish stipules, 1.5–2 mm long, ovate, acute and with ciliate margins, and lanceolate leaves with acuminate apices.

Paratypes. BRAZIL. **Rio Grande do Sul:** Bom Jesus, 15 Jan. 1942, *B. Rambo s.n.* (PACA 8870); Passo da Guarda, 15 Jan. 1952, *B. Rambo s.n.* (PACA 51899); Serra da Rocinha, 3 Feb. 1953, *B. Rambo s.n.* (PACA 53884-A); Farroupilha, 25 Nov. 1957, *Camargo 2620-B* (PACA); São Francisco de Paula, Serra do Fachinal, 14 Feb. 1946, *B. Rambo s.n.* (PACA 32134); Azulega, 15 Feb. 1946, *B. Rambo s.n.* (PACA 32241); Tainhas, 16 Feb. 1946, *B. Rambo s.n.* (PACA 32278); Cambará, Feb. 1948, *B. Rambo s.n.* (PACA 36145); Vacaria, Fazenda da Ronda, 10 Jan. 1947, *B. Rambo s.n.* (PACA 34982), Passo do Socorro, 26 Dec. 1951, *B. Rambo s.n.* (PACA 51463, PACA 51466).

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A New Species of *Vriesea* (Bromeliaceae) from the Atlantic Forest, Brazil

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Abstract. *Vriesea flava*, a new species from the Atlantic Forest of Brazil, is decribed and illustrated. It is distinguished in *Vriesea* sect. *Vriesea* (Bromeliaceae) from its closest relatives *V. paraibica*, *V. eltoniana*, *V. maxoniana*, and *V. laxa* mainly by the color and dimensions of its floral bracts and relative position of the stamens.

Key words: Atlantic Forest, Brazil, Bromeliaceae, *Vriesea*.

The genus *Vriesea* Lindley (Bromeliaceae) comprises about 230 species distributed in two sections, *Vriesea* and *Xiphion* (E. Morren) E. Morren (Smith & Downs, 1977; Luther & Sieff, 1994, 1997a, 1997b; Luther, 2001; Grant, 1995a, 1995b). Section *Vriesea* includes a group of species closely related to *V. paraibica* Wawra, which are distributed along the Atlantic Forest of southeastern and southern Brazil. For years specimens in this species group were misidentified in herbaria worldwide as *V.* × *morreniana* hortus ex E. Morren, based on Smith and Downs's (1977) interpretation. However, this taxon is an artificial hybrid between *V. psittacina* (Hooker) Lindley and *V. carinata* Wawra (Morren, 1882) and does not exist in nature (Costa, 1997).

The populations of the *Vriesea paraibica* complex were studied as part of the doctoral project of the first author, and the results of morphometric analysis indicate that two major groups form by the color and length of the floral bracts (Costa, 2002). Plants with entirely yellow bracts, yellow, orange, or green-tinged rachises, and lemon-yellow petals occur between São Paulo and Santa Catarina in Brazil. Reitz (1983) treated this group as *V.* × *morreniana*, but no longer considered it a natural hybrid due to its abundant occurrence and dispersal by seeds in nature. Though he kept the name, he did not adopt the broader concept, which Smith and Downs (1977) suggested for the taxon. This species is herein proposed as new, based on its singular combination of characters.

Vriesea flava A. F. Costa, H. Luther & M. G. L. Wanderley, sp. nov. TYPE: Brazil. São Paulo: Ribeirão Grande, Parque Estadual Fazenda Intervales, 7 May 1997 (fl), *M. G. L. Wanderley 2187 & B. A. Moreira, S. L. Proença, R. C. Forzza, F. Nascimento* (holotype, SP; isotype, R). Figure 1.

A *Vriesea paraibica* cui affinis, foliis 3.2 cm latis, bracteis floriferis 3 cm longis, luteis, sepalis 2.6 cm longis, petalis luteis apicem versus virescentibus differt. A *V. eltoniana* cui affinis, foliis 15–34 cm longis, rhachidibus viridibus vel aurantiacis, sepalis adaxialibus carinatis, petalis luteis differt. A *V. maxoniana* cui affinis, foliis 3.2 cm latis, bracteis floriferis 3 cm longis, sepalis 2.6 cm latis differt. A *V. laxa* cui affinis, stamina exserta differt.

Plant flowering to 45 cm tall. Leaves densely rosulate, suberect; sheaths oblong, 7 × 4.5 cm, pale green; blades linear, 26(15–34) × 3.2(2.6–3.8) cm wide, acuminate, bright green. Inflorescence simple, erect, 13(6–21)-flowered; scape to 25 cm long, sometimes sigmoid, yellow-green; scape bracts oblong, obtuse, apiculate, to 2.8 cm long, longer than the internodes, enfolding the scape, yellow-green; rachis 7.5(4.3–12) cm, yellow-green to orange; floral bracts ovate, acute, apiculate, carinate, slightly

Figure 1. *Vriesea flava* A. F. Costa, H. Luther & M. G. L. Wanderley. —A. Habit, showing inflorescence. —B. Closeup of inflorescence showing one flower exserted from floral bract. —C. Micrography of petal appendages (bar = 1 mm). —D. Micrography of stigma (bar = 2 mm). (All photos from the type collection, *M. G. L. Wanderley 2187 et al.*)

incurved near the apex, 3.0(2.6–3.7) × 2.5 cm (at base), yellow. Flowers suberect at anthesis, sometimes exserted from floral bract on one side; sepals linear, acute, the adaxial pair carinate, ca. 2.6(–3.2) cm long, yellow; petals linear, obtuse, ca. 4 cm long, yellow with a yellow-green erect apex, appendages with acute-irregular apex, ca. 1 cm long; stamens with the anthers exserted, functionally on the upper side of the corolla during anthesis; style longer than the stamens, stigma convolute-bladed. Fruits 3–3.5 cm long.

The *Vriesea paraibica* complex comprises a monophyletic group of nine species of section *Vriesea* with simple, complanate inflorescences with yellow or rarely red bracts, adaxial pair of sepals

Table 1. Features distinguishing *Vriesea flava* from its closest relatives. The boldfaced text indicates the distinctive characters between each species and *V. flava*.

Feature	*V. flava*	*V. paraibica*	*V. eltoniana*	*V. maxoniana*	*V. laxa*
Blade length	26 (15–34) cm	25–38 cm	**40 cm**	28–30 cm	15–18 cm
Blade width	3.2 (2.6–3.8) cm	**2.5–3.3 cm**	3–3.5 cm	**2.2 (2.0–2.5) cm**	**2.5 cm**
Color of scape	green to yellow-green	green	**red-purple**	green	green
Floral bract length	3.0 (2.6–3.7) cm	**3.5–4 cm**	2.9–3.4 cm	**4.5–5.5 cm**	2.5–3.4 cm
Color of floral bracts	yellow	**red with green apex**	yellow	yellow	yellow (rarely orange)
Sepal length	2.6 (–3.2) cm	**3.2 (2.7–3.7) cm**	2.7–3.1 cm	**3.7 (3.5–4.0) cm**	3.0–3.5 cm
Dorsal keel on the sepals	on the adaxial pair	on the adaxial pair	**on all three sepals**	on the adaxial pair	on the adaxial pair
Color of petals	yellow with yellow-green apex	yellow	**yellow with dull green tip**	yellow	yellow
Position of stamens	exserted	exserted	exserted	exserted	**included**
Geographical distribution	Brazil, São Paulo to Santa Catarina	Brazil, Rio de Janeiro, Minas Gerais and São Paulo, on Serra da Mantiqueira, Serra da Bocaina, and Serra dos Órgãos	Brazil, Rio de Janeiro, coastal semi-deciduous forests	Argentina, Salta; and Bolivia, Chuquisaca, La Paz, Santa Cruz, and Tarija	Venezuela, Aragua, Falcón, and Yaracuy

carinate, actinomorphic corolla, petals linear with transversal posture erect or recurved, yellow or greenish, appendages with acute-irregular apex, and exserted stamens (Costa, 2002).

Vriesea flava occurs in the Atlantic Forest about 800 m above sea level, in São Paulo, Paraná, and Santa Catarina States, Brazil. It is an epiphyte especially on the trunks and main branches of trees. *Vriesea paraibica*, a red bracteate species, occurs on the same altitudinal range on the Serra do Mar, between northeastern São Paulo State and Rio de Janeiro State (Table 1). Fieldwork and herbarium data (HB, HBR, MBM, R, RB, SP, UPCB) indicate that sympatric populations with red and yellow floral bracts are not known. Within the yellow bracteate species, *V. eltoniana* E. Pereira is also related, but differs from *V. flava* in the longer leaves, the red-purple rachis, the three sepals bearing a dorsal keel, and the petals yellow with dull green tips. *Vriesea eltoniana* has a restricted geographical distribution, occurring only in the coastal semi-deciduous forests in Rio de Janeiro State. *Vriesea flava* is also closely related to *V. maxoniana* (L. B. Smith) L. B. Smith from Argentina and Bolivia and *V. laxa* Mez from Venezuela. These two last species also belong to the same complex and are similar in appearance to *V. flava*, and could be interpreted as a single species. However, despite this relatively common circum-Amazonian geographic distributional pattern among several angiosperm species (Granville, 1992), the features shown in Table 1 were considered relevant to recognize *V. flava* as a new species.

Concerning the affinity between *Vriesea flava* and *V. laxa*, the exsertion and inclusion of the stamens can be interpreted as a relevant taxonomic character, considering also their disjunct distribution. Although the occurrence of individuals with exserted and included stamens has been observed in the same population of bromeliad species (*Tillandsia*, Gardner, 1986; *Vriesea*, Costa, unpublished data), all material of *V. flava* and *V. laxa* analyzed to date have shown only exserted or included stamens and stigmas, respectively.

The epithet *flava* refers to the completely yellow floral bracts. The morphometric analysis and taxonomic treatment of the *Vriesea paraibica* complex will be presented in two forthcoming papers.

Paratypes. BRAZIL. **Paraná:** Jacarezi, 4 June 1915 (fl), *Dusén 6765* (S); Campina Grande do Sul, Serra do Espia, 5 Apr. 1964 (fl), *G. Hatschbach & Joly 11145* (HB, HBR, MBM, UPCB). **São Paulo:** Tapiraí, 13 Dez. 1999 (fl), *H. Luther s.n.* (SEL 081296).

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Bulbophyllum boudetiana (Orchidaceae), a New Species from the Brazilian Atlantic Forest, Espírito Santo

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ABSTRACT. *Bulbophyllum boudetiana* Fraga (Orchidaceae), a new species from Espírito Santo that grows in saxicolous vegetation mats on an inselberg in the Brazilian Atlantic forest, is described, illustrated, and compared with related species. This new species is related to *Bulbophyllum kautskyi*, from which it differs by yellow flowers with cream spots, abbreviated rhizomes, aggregate and ovoid pseudobulbs, petals scale-shaped, labellum thick-fleshy, and disc slightly sulcate and ciliate on the base.

Key words: Atlantic forest, Brazil, *Bulbophyllum*, Espírito Santo, Orchidaceae.

The eastern Brazilian Atlantic coastal forest extends for more than 3000 km as an almost continuous band formed by a chain of mountain ranges that parallel the Atlantic Ocean, isolated by vast stretches of cerrado and caatinga from the moist forest of the Amazon basin and characterized by a high percentage of plant endemism (Mori et al., 1981). The high species richness of the vegetation mats and of most other plant communities on eastern Brazilian inselbergs is exceptional when compared to other tropical areas. Rock outcrops usually do not attract much agricultural interest: they have frequently been preserved from human impact and have kept their refugial character (Porembski et al., 1998). As a result of fieldwork at various inselbergs in Espírito Santo, I have found a new orchid species on the Pedra Branca (white rock) inselberg that is described and illustrated in this paper.

Currently 1100 species are recognized in *Bulbophyllum* Thouars, which has a pantropical distribution (Dressler, 1993). The last revision of this genus for Brazil was that of Cogniaux (1902), in which 42 species were recorded; according to Pabst and Dungs (1975, 1977) this number was raised to 54. Since then, 3 species have been described in recent publications of Borba et al. (1998), Fraga (1999), and Brito (2000), making a total of 57 species.

Bulbophyllum boudetiana Fraga, sp. nov. TYPE: Brazil. Espírito Santo: Serra, Pedra Branca, elev. 300 m, 11 July 2000 (fl), *C. N. Fraga 636* (holotype, MBML; isotype, RB). Figure 1.

Haec species *Bulbophyllo kautsky* similis, sed pseudobulbis aggregatis et ovoideis, petalis squamiformibus, labello crasse carnoso et ciliato cum marginibus non revolutis differt.

Plants epiphytic, creeping, up to 4 cm tall. Roots many, 0.5 mm diam., fasciculate, terete, glabrous, emerging near the margins with the pseudobulb. Rhizomes ca. 2 mm diam., abbreviated, internodes 2–3 mm long. Pseudobulbs 6–8 × 5–8 mm, aggregate, erect, ovoid, each 4-angled, monophyllous, yellow. Leaves 18–32 × 6–8 mm, sessile, oblong to elliptic-oblong, erect-patent, coriaceous, obtuse-attenuate at base, apex acute-apiculate, green. Inflorescence emerging from below pseudobulb, up to 25 cm long, spicate, usually pendulous, producing 10 to 15 flowers, green to yellow; peduncle 11–13 cm long, terete, elongate, with small, appressed, tubular, widely spaced, 4 to 5 pale sterile bracts; rachis 10–12 cm long, straight to flexuous, sub-terete; floral bracts 3–4 × 1–2 mm, ovate-triangular, amplexicaul, acute-acuminate, usually spreading, yellow or green when young and paleaceous at anthesis. Flowers opening in succession, occasionally 2 flowers at anthesis simultaneously, yellow with brown cream spots; ovary with pedicel up to 1.5 mm, slightly obconical, sulcate, somewhat twisted and curved, cream; dorsal sepal 3.5–4.5 × 2–3 mm, ovate-lanceolate, glabrous, concave, acuminate, 3-veined, yellowish with nut-brown spots; lateral sepals 5–6.5 × 2.5–3.5 mm across the basal portion, free, glabrous, triangular-ovate, distinctly acuminate, oblique, deflexed, 3-veined, yellow toward apex with cream points toward base; petals small, 0.4–0.6 × 1.5–2 mm, covered with scales, glabrous, appressed to column, yellow toward apex and translucent toward base; labellum 4.5–5.5 × 2–3 mm, up to 2 mm wide when spread, articulate with the column foot, thick-fleshy, ovate-ligulate from above, disc slightly sulcate and ciliate at the

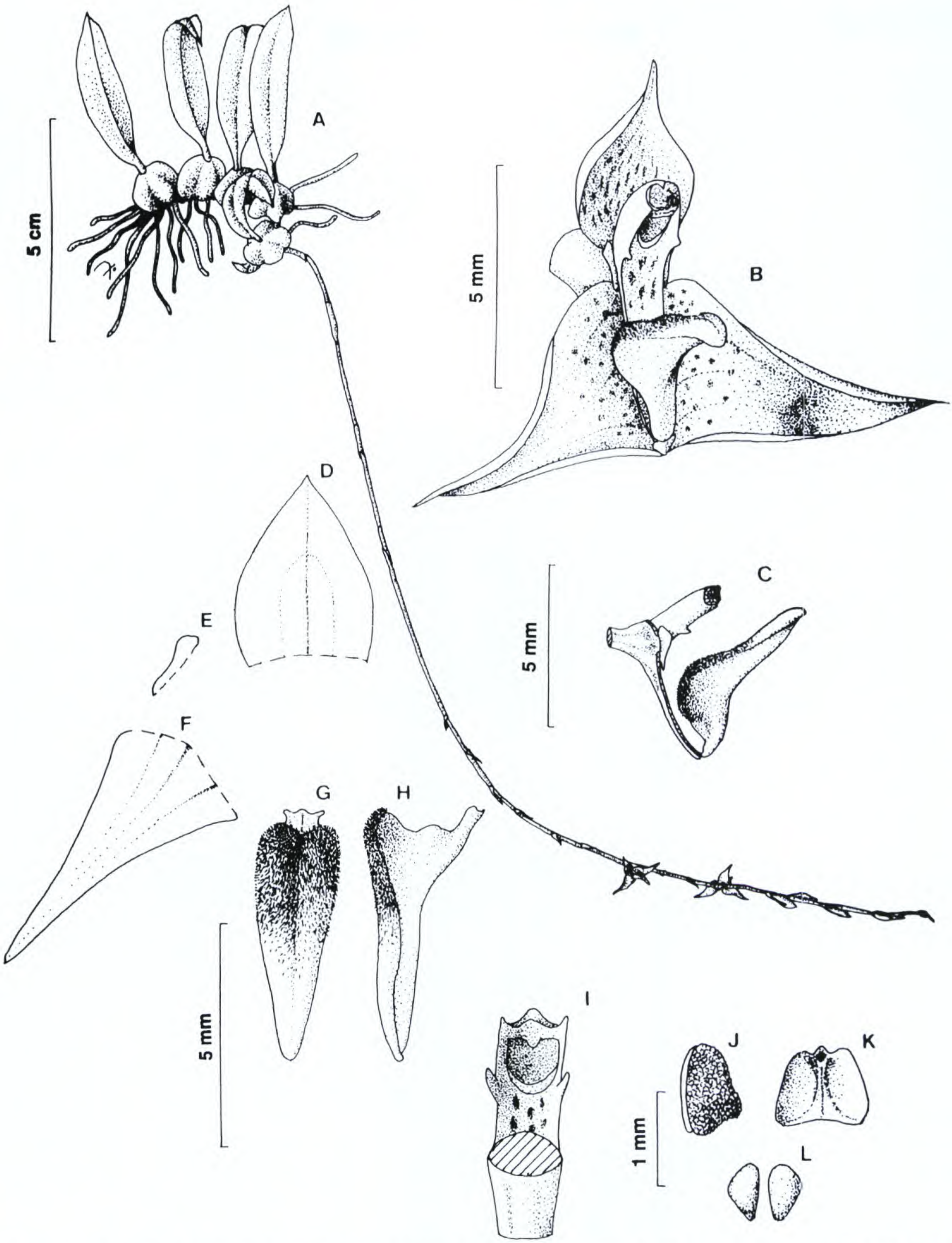

Figure 1. *Bulbophyllum boudetiana* Fraga. —A. Habit and inflorescence. —B. Flower. —C. Ovary, petals, lip, and column in side view with sepals removed. —D. Dorsal sepal, from above. —E. Petal, from above. —F. Lateral sepal, from above. —G. Lip, from above. —H. Lip, in side view. —I. Ovary and column in lower view. —J. Anther in side view. —K. Anther, from below. —L. Pollinia. Drawn from the holotype (*C. N. Fraga 636*), by C. N. Fraga.

base, geniculate in side view, abaxially provided with an amorphous callosity or keel, base geniculate, apex acute; column 1–1.5 × 0.5–0.7 mm, thick, provided with two rudimentary arms at apex and two small falcate teeth on the abaxial margins or less in the middle, prolonged into 3.5–4 mm long, curved foot, white with nut-brown spots on the abaxial face; anther 1 × 1 mm, apical, versatile, papillose, two pairs of pollinia, white.

Etymology. The name of the new species pays homage to Helio de Queiroz Boudet Fernandes, director of the Mello Leitão Biological Museum and Herbarium MBML curator in Santa Teresa, Espírito Santo.

In the field, *Bulbophyllum boudetiana* is recognized by its yellow flowers with cream spots, abbreviated rhizomes, 2–3 mm between the aggregate and ovoid pseudobulbs, petals covered with scales, labellum thick-fleshy, and disc slightly sulcate and ciliate at the base and with non-revolute margins; *Bulbophyllum kautskyi* Toscano has dark purple flowers, with usually green spots and yellow base, woody rhizomes with several articulations, 15–20 mm between the conical to narrowly ovoid pseudobulbs, petals acute, labellum fleshy, and disc slightly sulcate and glabrous and with revolute margins.

The new species is known only from the type locality but may be expected in adjacent saxicolous vegetation mats on inselbergs in the Brazilian Atlantic forest in Espírito Santo.

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New Species and Taxonomic Changes in *Styrax* (Styracaceae) from South America

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Abstract. Taxonomic modifications are made within *Styrax* series *Valvatae* (Styracaceae) in South America. *Styrax chrysocalyx*, *S. griseus*, *S. nunezii*, and *S. trichostemon* are described as new and illustrated. *Styrax guaiquinimae* (based on *S. tepuiensis* subsp. *guaiquinimae*), *S. neblinae* (based on *S. duidae* subsp. *neblinae*), *S. rotundatus* (based on *S. martii* var. *rotundatus*), and *S. yutajensis* (based on *S. guanayanus* var. *yutajensis*) are recognized at the species level. Lectotypes are selected for *S. martii* and *S. martii* var. *rotundatus*. The discovery of *S. trichostemon* supports the sister-group relationship between the gynodioecious clade and the rest of *S.* series *Valvatae* as inferred from a previously published molecular phylogenetic analysis.

Key words: South America, Styracaceae, *Styrax*.

Styrax L. (Styracaceae) consists of about 130 species distributed in the Americas, the Mediterranean region, and eastern Asia through Malesia. Fritsch (1999), in revising the infrageneric classification of *Styrax*, recognized two sections (*S.* sect. *Styrax* and *S.* sect. *Valvatae* Gürke), each with two series. The largest of the series (*S.* ser. *Valvatae* Perkins of *S.* sect. *Valvatae*; about 80 species) is endemic to the Neotropics. Species of this series are easily distinguished from other members of *Styrax* by the combination of persistent leaves and a fleshy to juicy, indehiscent mesocarp (Fritsch, 1999). Since the last worldwide monograph of *Styrax* (Perkins, 1907), the Mexican, Mesoamerican, and Antillean species of *S.* series *Valvatae* have been comprehensively revised (20 species; Gonsoulin, 1974; Fritsch, 1997), as have the members of the strictly South American *Pamphilia* group of this series (six species; = *Pamphilia* Martius ex A. DC., *S.* sect. *Pamphilia* (Martius ex A. DC.) B. Wallnöfer; Wallnöfer, 1997). Despite the serious need for a similar revision of the remaining members of *S.* series *Valvatae* (Fritsch, 1999), only regional treatments for this group exist (e.g., Macbride, 1959; Maguire & Huang, 1978; Fritsch & Steyermark, in press; Fritsch et al., 2002). As a prelude to a comprehensive taxonomic revision of Neotropical *Styrax*, four South American species of the genus are here newly described. Furthermore, one Brazilian taxon is elevated in rank from variety (*S. martii* var. *rotundatus* Perkins) to species, and lectotypes are chosen for both *S. martii* Seubert and *S. martii* var. *rotundatus*. Finally, three taxa are elevated in rank from either the subspecies or varietal level to the species level specifically in preparation for the treatment of Styracaceae for the *Flora of the Venezuelan Guayana*.

Styrax chrysocalyx P. W. Fritsch, sp. nov. TYPE: Brazil. Rio de Janeiro: Itatiaia, road from Monte Serrat to Maromba, 900–1100 m, 20 Oct. 1927 (fl), *H. Zerny s.n.* (holotype, W). Figure 1.

Arbor sempervirens. *Lamina* 13.6–21 × 6.7–10.8 cm chartacea, ovato-elliptica vel elliptica, apice brevi-acuminato, subtus pilis densis minutis albi-stellatis instructa, magis dispersis rigidis albi- vel fulvo-stellatis brachiis usque 0.7 mm longis intermixtis, venis tertiariis et quaternariis elevatis, paginis venarum tertiariarum fulvis plerumque manifestis subter indumentum, paginis venarum quaternariarum non manifestis subter indumentum. *Inflorescentiae* 6.5–11 cm longae. *Flos* 15–17 mm longus; *calyx* 5–7 × 8 mm dense aureo-fusco-stellato-hirsutus, ad medium brachiis pilorum usque 1 mm longis; *stamina* 10; *filamenta* ventraliter auriculata, infra auriculas 2 cristis prominentibus fulvo-aureo-stellato-tomentosis instructa, dorsaliter dense radiato-lepidota; *anthera* 7 mm longa loculis linearis ad apicem contractis; *connectivum* grande incurvum locula superante; *stylus* filiformis; *ovula* multa.

Evergreen tree to 4 m tall; young twigs gray-brown to brown stellate-tomentose. Petiole 9–15 mm long; lamina 13.6–21 × 6.7–10.8 cm, 1.6–2.3 times as long as wide, chartaceous, ovate-elliptic or elliptic, secondary veins 9 to 14 on each side of midvein; apex short-acuminate; base broadly cuneate to rounded; adaxially glabrous except on midrib, midrib and secondary veins slightly impressed; abaxially gray-green to the naked eye, with a dense base tomentum of minute green-white stellate trichomes, and more scattered, stiff, white to tawny stellate trichomes with arms to 0.7 mm long, tertiary veins raised, their tawny surfaces usually visible

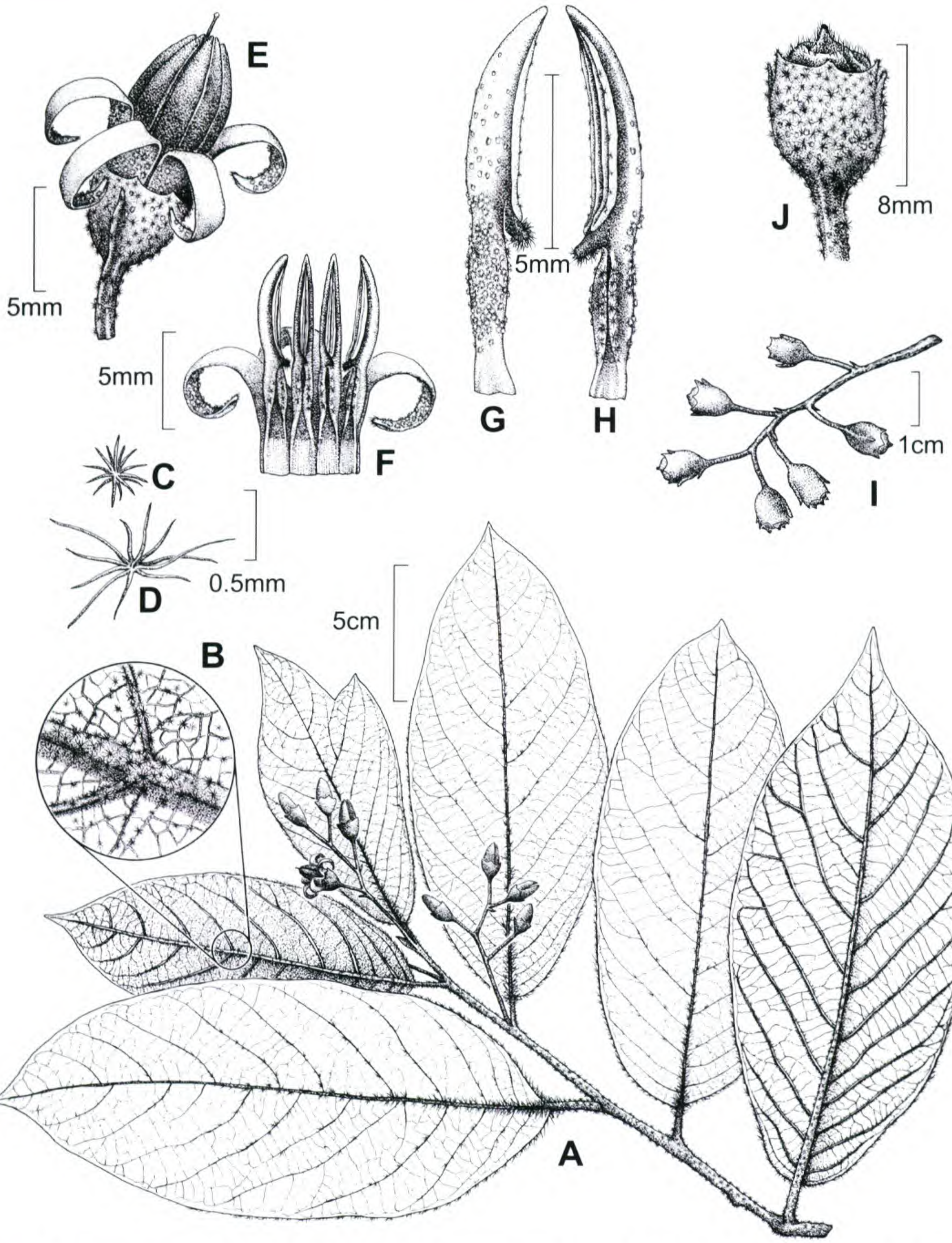

Figure 1. *Styrax chrysocalyx* P. W. Fritsch. —A. Flowering branch. —B. Leaf surface, abaxial view. —C. Stellate trichome from the base tomentum of the abaxial side of the leaf. —D. Larger stellate trichome from the abaxial side of the leaf. —E. Flower. —F. Part of corolla + androecium, opened. —G. Stamen, dorsal view. —H. Stamen, ventral view. —I. Immature infructescence. —J. Immature fruit. A–H based on the holotype, 20 Oct. 1927, *Zerny s.n.* (W); I, J based on *Irwin 2231* (UC).

through the pubescence, quaternary veins raised, their surfaces not visible through the pubescence; margin entire. Inflorescences axillary or terminal, racemose, one per node, 6.5–11 cm long, 4- to 6-flowered, densely golden brown stellate-hirsute, trichomes with somewhat stiff arms to 0.7 mm long; lower pedicels 11–18 mm long. Flowers hermaphroditic, 15–17 mm long; calyx 5–7 × 8 mm, broad-

ly cupuliform, the dense gray-green base tomentum of minute trichomes visible at the calyx margin, otherwise densely golden brown stellate-hirsute, trichomes at mid-calyx with arms to 1 mm long, margin truncate between the minute teeth, inner margin sparsely glandular; corolla 13–15 mm long, white; tube 2.5 mm, extending up to the calyx margin; lobes 5, 11–13 × 2.5–3 mm, reflexed, thin; stamens 10; free portion of stamen tube absent; distinct portion of filaments 4.5 mm long, ventrally with prominent auricles bearing a dense mass of tawny-golden stellate trichomes with arms to 0.5 mm long or nearly glabrous, below the auricles with 2 prominent densely tawny golden stellate-tomentose longitudinally oriented ridges, dorsally densely radiate-lepidote; anthers 7 mm long, the massive, incurved, densely radiate-lepidote (sparsely so distally) connectives exceeding the linear, apically tapered, glabrous thecae by ca. 1 mm; ovary densely tawny stellate-tomentose; style filiform, glabrous; ovules many. Mature fruit unknown.

Habitat, distribution, and phenology. Known through two collections from southeastern Brazil, only one of which has habitat information, in secondary forest growing on red clay at 900–1100 m, flowering October.

The first collection of this species was made in 1927, and apparently no attempt was made to identify it until 1990, when it was annotated as *Styrax oblongus* (Ruiz & Pavón) A. DC. The species was collected again in 1958 with a label determination of *S. latifolius* Pohl. *Styrax chrysocalyx* differs from both of these species through its incurved (vs. straight) anthers, prominent (vs. inconspicuous or absent) ventral stamen filament auricles subtended by two prominent longitudinal ridges (vs. filaments planar or merely incurved below the auricles), and lepidote (vs. glabrous) connectives. The combination of these features matches no other species of *Styrax*, and the prominent filament ridges and strongly incurved anthers appear to be unique in the genus. The presence of the filament auricles and prolonged connectives in this species suggest affinities to a group of *Styrax* species otherwise endemic to the Andes. *Styrax chrysocalyx* is apparently rare across its narrow range and is probably in danger of extinction if it is not already extinct.

Paratype. BRAZIL. **Minas Gerais:** Ponte Nova, Fazenda Varginha, 12 km E of Ponte Nova, 7 Dec. 1958, *H. S. Irwin 2231* (MICH, NY, R, TEX, UC, US).

Styrax griseus P. W. Fritsch, sp. nov. TYPE: Brazil. Pará: Marabá, along Highway p/N1, DOCEGEO camp, 20 May 1982 (fl, fr), *R. S. Secco, C. Sperling, M. Condon, A. Mesquita, B. Gilberto R. & L. Marinho 257* (holotype, CAS). Figure 2.

Arbor vel frutex sempervirens. *Lamina* 4.6–11.1 × 2.5–5.5 cm crassi-chartacea, elliptica vel ovato-, oblongo-, vel lanci-elliptica, apice obtuso vel brevi-acuminato, supra albi-stellato-hirsutula, subtus pilis densis minutis viridigriseis instructa, magis dispersis aurantiaco- vel aureostellatis brachiis usque 0.1 mm longis intermixtis, venis cinnamomeis vel fuscis, venis tertiariis leviter elevatis, venis quaternariis non elevatis, paginis venarum tertiariarum manifestis subter indumentum, paginis venarum quaternariarum non manifestis subter indumentum; margine revoluto. *Inflorescentiae* 2–5.5 cm longae. *Flos* 11–14 mm longus; *calyx* 3.5–5 × 3.5–5 mm dense griseo-viridi-stellato-tomentosus, ad medium brachiis pilorum usque 0.1 mm longis; *stamina* 10; *filamenta* ventraliter non auriculata pilis albi-stellatis brachiis usque 1.5–2.0 mm longis instructa, dorsaliter glabra; *anthera* 5–6 mm longa loculis linearis ad apicem contractis; *connectivum* locula aequante vel leviter superante; *stylus* filiformis; *ovula* multa. *Drupa* 6–9 × 5–6 mm, griseo-viridis, ellipsoidea vel globosa, apice depresso.

Evergreen shrub or tree to 4 m tall; young twigs densely brown stellate-tomentose. Petiole 5–13 mm long; lamina 4.6–11.1 × 2.5–5.5 cm, 1.8–2.5(–2.9) times as long as wide, thick-chartaceous, elliptic or ovate-, oblong-, or lance-elliptic, secondary veins 6 to 8(9) on each side of midvein; apex obtuse to short-acuminate; base broadly cuneate to subrounded; adaxially white stellate-hirsutulous, even on old leaves; abaxially dull gray or green-gray to the naked eye, with a dense base tomentum of dull minute green-gray stellate trichomes and widely scattered orange or golden yellow stellate trichomes with arms ± the same size as those of the base tomentum (to 0.1 mm long), the cinnamon to brown surface of the primary through tertiary veins visible through any pubescence, tertiary veins slightly raised, quaternary veins not raised, not visible through the pubescence; margin entire, revolute. Inflorescences axillary or terminal, racemose (rarely paniculate or 1- or 2-flowered), 1 or 2 per node, 2–5.5 cm long, 3- to 7-flowered, densely olive-green to brown stellate-tomentose, rachis slender; lower pedicels 3–6(–10) mm long. Flowers hermaphroditic, 11–14 mm long; calyx 3.5–5 × 3.5–5 mm, cupuliform, densely gray-green stellate-tomentose, trichomes at mid-calyx with arms to 0.1 mm long, margin truncate between the minute teeth, inner margin densely glandular; corolla 9–12 mm long, white; tube 2 mm long, extending up to the calyx margin; lobes 5, 7–10 × 1.5–2 mm, reflexed, thin; stamens 10; free portion of stamen tube to 0.5 mm

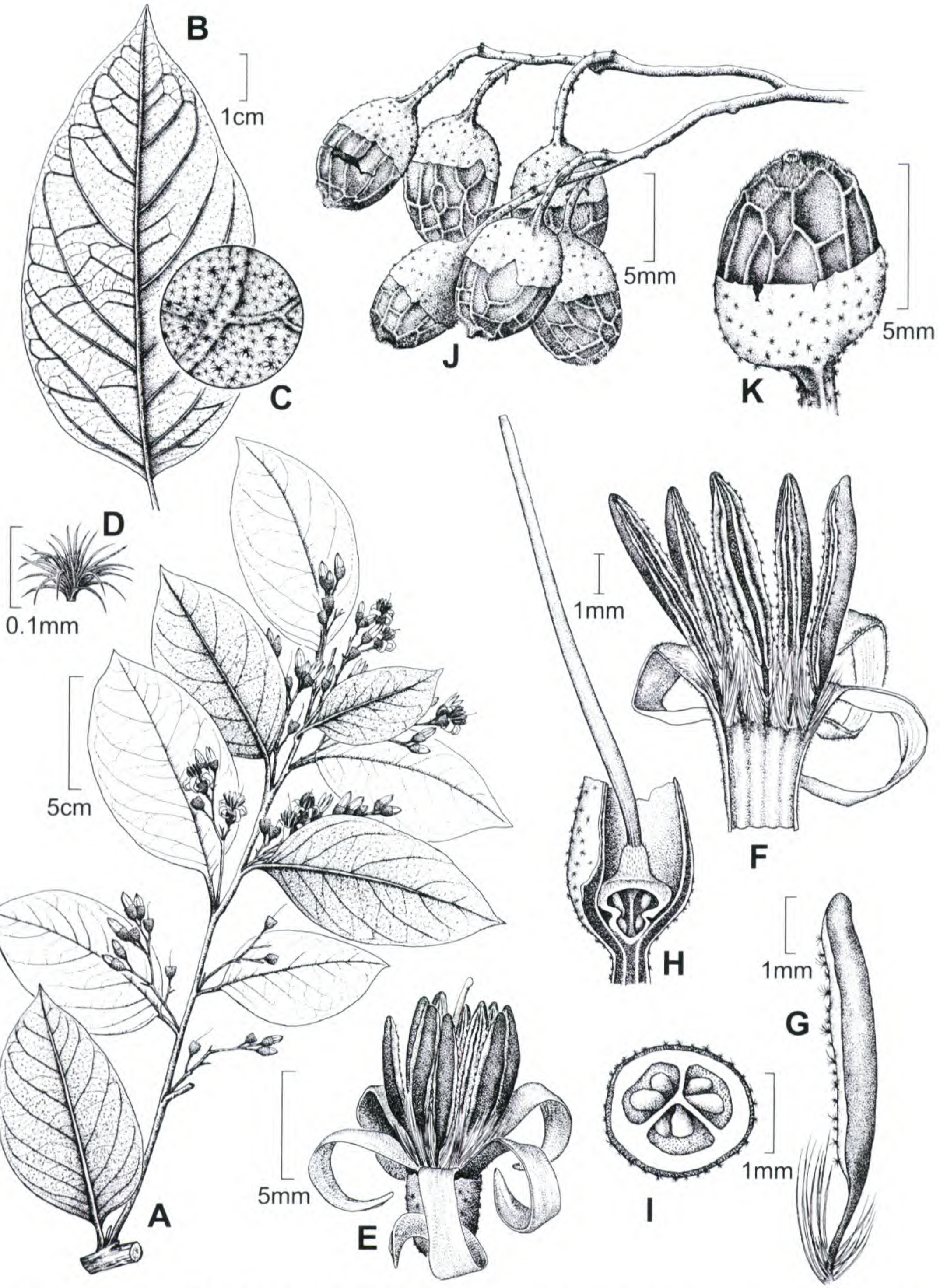

Figure 2. *Styrax griseus* P. W. Fritsch. —A. Flowering branch. —B. Leaf, abaxial view. —C. Leaf surface, abaxial view. —D. Stellate trichome from the abaxial side of the leaf. —E. Flower. —F. Part of corolla + androecium, opened. —G. Anther, lateral view. —H. Calyx + gynoecium, long-section. —I. Ovary, cross section. —J. Infructescence. —K. Mature fruit. A–I based on *Ratter et al. 1284* (K); J, K based on *Ribeiro 1382* (IAN).

long; distinct portion of filaments 2 mm long, ventrally without auricles, bearing a dense mass of somewhat stiff white stellate trichomes with arms to 1.5–2 mm long, the trichomes nearest the proximal end of the filament with arms predominantly pointing downward, those nearest the distal end with arms pointing upward, sinuses between the filaments densely stellate-hispid, trichomes with arms to 3.5 mm long, dorsally glabrous; anthers 5–6 mm long, the glabrous connectives ± equal to or slightly exceeding the linear, abruptly tapered, densely pubescent thecae; ovary densely gray-green stellate-tomentose; style filiform, glabrous; ovules many. Drupe 6–9 × 5–6 mm, gray-green, ellipsoid to subglobose, apex depressed, often annular-sulcate around the remains of the style base; wall irregularly and coarsely rugose on herbarium specimens; fruiting calyx broadly cupuliform, 3–4 × 4–6 mm, 0.45–0.67 times the length of the drupe proper.

Habitat, distribution, and phenology. Endemic to Brazil, occurring in the states of Bahia, Mato Grosso, Pará, and Rondônia in terra firme forest, scrub on rock outcrops, cerrado, cerradão, canga, capões, and roadsides at 450–950 m, flowering February, March, May, June, August, December, fruiting March–October.

Styrax griseus was first collected in 1964 in the state of Mato Grosso, Brazil, but despite at least 36 other collections of this species made since that time, it has remained unrecognized until now. The species seems closest morphologically to *S. camporum* Pohl and *S. pohlii* A. DC., with which it shares a similar leaf size and shape, relatively small flowers (11–14 mm long) and fruits (6–9 × 5–6 mm long), non-auriculate stamen filaments, and linear thecae. The most obvious difference between *S. griseus* and these species is the dull gray to gray-green cast to the abaxial surfaces of the leaves (for which the species is named) caused by the color of the short tomentum, versus usually longer, green-gray, green-white, or white stellate trichome covering, often with larger, scattered ferrugineous trichomes additionally present. The abaxial leaf surfaces of the Amazonian phase of *S. pohlii* are sometimes dark gray, but then are either not notably revolute or in possession of larger ferrugineous trichomes. In addition, the mature leaves of *S. griseus* are stellate-pubescent adaxially, whereas in *S. camporum* and *S. pohlii* the leaves are glabrous or glabrescent adaxially, at most retaining pubescence along the midrib proximally. Furthermore, the connectives of *S. griseus* are slightly prolonged apically beyond the tapered thecae, whereas in *S. camporum* and *S. pohlii* the non-tapered thecae are roughly equal to the connectives or prolonged beyond them.

Isotypes of *Styrax griseus* are to be expected at MG and NY.

Paratypes. BRAZIL. **Bahia:** Espigão Mestre, ca. 100 km WSW of Barreiras, 8 Mar. 1972, *W. R. Anderson et al. 36851* (C, F, K, NY, US); Igaporã, Highway BR–430, near road to Tanque Novo, 18 Mar. 1995, *G. Hatschbach 62031* (MBM); drainage of the Rio Corrente, ca. 5 km S of Rio Roda Velha, 15 Apr. 1966, *H. S. Irwin et al. 14882* (C, F, K, NY, US); São Desidério, Fazenda Duas Pátrias, bank of Rio Grande, Sítio Grande, 12 Dec. 1982 (fl), *C. Proença 324* (F); Correntina, Fazenda Jatobá, 9 Jan. 1991, *A. V. Rezende et al. 129* (UB[2]), 6 June 1992, *M. A. da Silva et al. 1339* (RB, UB), 2 Mar. 1991, *L. G. Viollati et al. 197* (CAS, K, UB). **Mato Grosso:** ca. 8 km from Utiariti, 5 Mar. 1978, *R. Becker 4* (F, RB[2]); Padronal, Vila Bela da Santissima Trinidade, BR–364, Cuiabá–Porto Velho, 9 June 1984, *C. A. Cid et al. 4410* (F, GH, INPA, MICH, NY); Padronal, Vila Bela da Santissima Trinidade, BR–364, Cuiabá–Porto Velho, Km 80, 10 June 1984, *C. A. Cid et al. 4435* (INPA, K, NY); vicinity of Garapú, 1 km NE of Garapú, 2 Oct. 1964, *H. S. Irwin & T. R. Soderstrom 6581* (C, F, LL, NY, UC, US); 1 km N of base camp, 16 Dec. 1967, *D. Philcox et al. 3542* (K); N of base camp, 28 Feb. 1968, *D. Philcox & A. Fereira 4372* (K, NY, U); ca. 0.5 km W of Km 264, road from Xavantina to Cachimbo, 20 Mar. 1968 (fl), *D. Philcox & A. Fereira 4589* (K, MO, NY, U, UC); Sararé, Radambrasil, 4 Aug. 1978, *J. M. Pires & M. R. Santos 16421* (NY); Charravascal, 140 km N of Paranatinga, 16 Sep. 1980, *J. M. Pires & P. P. Furtado 17104* (INPA, MO); 6 km S of Base Camp, ca. 270 km N of Xavantina, 4 May 1968 (fl), *J. A. Ratter et al. 1284* (IAN, K, MO, NY, U, UC); 2 km N of the Base Camp of the Expedition, ca. 270 km N of Xavantina, 29 May 1968, *J. A. Ratter et al. 1578* (K, NY); Nobres, road to Fazenda Santana, 9.6 km S of Rio Celeste, 19 Sep. 1985, *W. Thomas et al. 3907* (CAS, INPA). **Pará:** Itaituba, Highway BR–163 from Santarém to Cuiabá, Km 794, Serra do Cachimbo, Base Aérea, Cachimbo Airport, 27 Apr. 1983, *I. L. Amaral et al. 992* (F, GH, INPA, K, NY, RB); Cachimbo, edge of airport of the Serra do Cachimbo, 19 July 1977, *W. Benson* (INPA[2]); Marabá, Serra Norte, Serra dos Carajás, Mine N–1, 18 Apr. 1970, *P. Cavalcante 2646* (INPA); Serra do Cachimbo, Capoeira de Campina along Highway BR–163 from Cuiabá to Santarem, Km 852, 17 Feb. 1977, *J. H. Kirkbride Jr. & E. Lleras 2869* (INPA); Serra Norte, Serra dos Carajás, Mine N–1, 3 June 1986, *M. P. M. de Lima et al. 135* (CAS); Serra Norte, 19 Aug. 1973, *J. M. Pires & B. C. Passos 13190* (IAN, INPA); Marabá, Serra dos Carajás, 26 June 1976, *B. G. S. Ribeiro 1376* (RB), *1382* (IAN, RB), 29 Oct. 1985, *R. S. Secco & O. Cardoso 662* (MO), 15 Mar. 1984, *A. S. L. da Silva et al. 1832* (INPA, NY), 2 June 1983, *M. F. F. da Silva et al. 1308* (IAN, INPA), 2 Apr. 1977, *M. G. Silva & R. Bahia 2995* (INPA, MICH, NY[2]), 28 Aug. 1972, *N. T. Silva & B. S. Ribeiro 3630* (IAN); 2 km E of AMZA camp N–1, 25 May 1982, *C. R. Sperling 5825* (CAS). **Rondônia:** Porto Velho–Cuiaba, Km 642, 8 Mar. 1976, *P. Bamps 5472* (BR, K, NY, RB, US), 6 July 1977, *J. Oliveira* (CAS); Fazenda Cachoeira, 144 km S of Pimenta Bueno on Highway BR–364 to Vilhena, 19 Aug. 1999, *J. A. Ratter et al. R8240* (E).

Styrax guaiquinimae (Maguire & Steyermark) P. W. Fritsch, stat. nov. Basionym: *Styrax tepuiensis* subsp. *guaiquinimae* Maguire & Steyermark, Mem. New York Bot. Gard. 29: 218. 1978. TYPE: Venezuela. Bolívar: Cerro Guaiquinima, Río Paragua, Cumbre Camp, 2000 m, 25 Dec. 1951 (fl), *B. Maguire 32758* (holotype, NY; isotype, IAN).

Habitat, distribution, and phenology. Endemic to the summit of Cerro Guaiquinima, Bolívar state, Venezuela, in shrub islands and rocky savannas with sandstone at 1400–2000 m; flowering December, fruiting May.

This species was originally described as a subspecies of *Styrax tepuiensis* Steyermark & Maguire (as *S.* subsp. *guaiquinimae* Maguire & Steyermark). *Styrax guaiquinimae* is easily distinguished from *S. tepuiensis* by the abaxial leaf and calyx surfaces, both of which are stellate-lanate in *S. guaiquinimae* and lepidote in *S. tepuiensis*. I consider *S. tepuiensis* to be merely a thick-leaved form of *S. glaber* Swartz, a species ranging widely across Venezuela and northern Guyana, extending north through the Lesser Antilles (Fritsch, unpublished data). *Styrax guaiquinimae* is similar to *S. longipedicellatus* Steyermark, also endemic to the Guayana Highland, but differs by its narrower (1.9–3.3 cm wide vs. 3.2–4.6 cm wide), coriaceous (vs. chartaceous to subcoriaceous) leaves with thick (vs. thin) abaxial leaf tomentum, and the lateral leaf veins impressed to sulcate on the upper surface (vs. the upper surface planar). The extent of morphological differences between *S. guaiquinimae* and *S. longipedicellatus* clearly justifies the recognition of *S. guaiquinimae* at the species level.

Additional specimens examined. VENEZUELA. **Bolívar:** Heres, Meseta del Guaiquinima, NE sector of the meseta, 27 Mar. 1985, *O. Huber 10416* (MO, NY, US, VEN); Cerro Guaiquinima, Río Paragua, 1 km S of Cumbre Camp, 29 Dec. 1951, *B. Maguire 32814* (NY, VEN); Cerro Guaiquinima NE sector, near the border, vicinity of the headwaters of the NE branch of Río Carapo, 25 May 1978, *J. A. Steyermark et al. 117368* (F, MO, U); Cerro Guaiquinima, SE sector, near the border, *J. A. Steyermark et al. 117442* (MO, VEN).

Styrax martii Seubert, in Martius, Fl. Bras. 7: 194. 1868. TYPE: Brazil. Minas Gerais: Serra de Piedade near Caeté, May, *C. F. P. von Martius s.n.* (lectotype, selected here, M herb. no. 56; photo of lectotype, F, GH, MICH, M, MO, NY).

Styrax martii var. *microphyllus* Perkins, Pflanzenr. 4, 241: 40. 1907 (as *S.* "*microphylla*"). TYPE: Brazil. São Paulo: between Jacareí and Moji das Cruzes, Dec. (fl), *C. F. P. von Martius 526* (holotype, M).

Evergreen shrub or tree to 6(–15) m tall; young twigs densely dark brown stellate-lanate. Petiole (7–)10–19 mm long; lamina 5.9–11.7 × 2.6–6.0 cm, 1.7–2.3 times as long as wide, thick-chartaceous to subcoriaceous, broadly elliptic, ovate, or lance-ovate, secondary veins (5)6 to 9 on each side of midvein; apex acute to acuminate; base broadly cuneate to rounded, occasionally slightly truncate; adaxially densely dark ferrugineous stellate-lanate when young, glabrescent except on major veins; abaxially dark ferrugineous or brown to the naked eye, with a dense base tomentum of gray-white stellate trichomes, and abundant but more scattered dark ferrugineous woolly trichomes with arms to 0.1–0.2 mm long often completely obscuring the white base tomentum beneath especially in young leaves, sparse to absent in old leaves, tertiary and quaternary veins usually not well differentiated from each other, moderately raised, their surfaces not visible through the pubescence; margin entire or occasionally coarsely 1- to 3-toothed. Inflorescences axillary or terminal, racemose (or 1- or 2-flowered), 1(2) per node, 2.5–3.5 cm long, 3- to 6-flowered, subtending leaves often highly reduced, densely dark ferrugineous stellate-lanate; lower pedicels 1–5 mm long or nearly absent. Flowers hermaphroditic, 13–18 mm long; calyx 5–8 × 4–5 mm, narrow-cupuliform to subcylindrical, striate proximally, densely brown stellate-lanate, trichomes at mid-calyx with arms to 0.1 mm long, margin truncate, concave, or erose between the minute teeth, inner margin eglandular; corolla 11–16 mm long, white; tube 5–8 mm long, extending up to 4 mm beyond the calyx margin; lobes 5, 5–8 × 1.5–2.5 mm, spreading, thickened; stamens 10; free portion of stamen tube to 1 mm long; distinct portion of filaments 2 mm long, ventrally without auricles, bearing a dense mass of white stellate trichomes, the slightly undulate arms to 1 mm long, trichomes nearest the proximal end of the filament with arms not predominantly pointing in any particular direction, those nearest the distal end with arms predominantly pointing upward, dorsally white stellate-pubescent; anthers 3.5–4 mm long, the glabrous connectives ± equal to the linear, apically slightly tapered, stellate-pubescent thecae; ovary densely gray-green stellate-pubescent; style filiform, glabrous; ovules many. Drupe 9–16 × 6–7 mm, olive-green, ovoid to obovoid-ellipsoid, apex depressed, annular-sulcate around the remains of the style base; wall irregularly and coarsely rugose on herbarium specimens; fruiting calyx 6–10 × 6–8 mm, 0.5–0.8 times the length of the drupe proper.

Habitat, distribution, and phenology. Forests

and forest edges on hillsides and along rivers, campo rupestre among rocks and on steep iron-rich slopes and outcrops, campo de altitude, and capões at 1000–1800 m; flowering November–April, July, fruiting January–March, July, December.

A complete description and list of additional specimens examined of *Styrax martii* is provided here to clearly delimit this species from *S. rotundatus*, a taxon that I elevate to the level of species from *S. martii* var. *rotundatus* (see below).

Seubert (1868) listed several collections in the protologue of *Styrax martii*: unspecified collections of Martius (denoted only as "*M.*"), *Blanchet 3641* (assumed here to be a transcription error of *3614* because I have not been able to locate specimens of *Blanchet 3641* and *Blanchet 3614* is annotated as *S. martii* by Seubert), and *Gardner 4395*; thus, these collections are syntypes. Because I consider *Blanchet 3614* to belong to *S. rotundatus* (see below) and because I have not been able to locate collections of *Gardner 4395* despite examination of loaned specimens from numerous European herbaria, I have selected a Martius sheet (M herb. no. 56) as the lectotype of *S. martii*. I have chosen this sheet rather than the other Martius sheets of *S. martii* that I have seen from M (herb. nos. 47, 54 (*Martius 526*), 55, 57, and 58) because (1) herb. no. 47 is a specimen of *S. rotundatus* (see below) and herb. no. 54 (*Martius 526*) is the type of *S. martii* var. *microphyllus* Perkins; (2) the sheet has been annotated by Seubert as *S. martii* (like the others); (3) the sheet has more locality data than the others; and (4) unlike the others, photographs of this collection have been deposited in other major herbaria.

A second variety of *Styrax martii* (*S. martii* var. *microphyllus*), with the type *Martius 526* (Perkins, 1907), was distinguished from *S. martii* var. *martii* in the protologue by its small leaves. This character to me is taxonomically trivial and thus I consider *S. martii* var. *microphyllus* to be a synonym of *S. martii*. A third variety of *S. martii* (*S. martii* var. *gracilius* Warming) I consider to be a taxonomic synonym of *S. lancifolius* Klotzsch ex Seubert.

Additional specimens examined. **Locality unspecified:** *P. Claussen 277* (W); *F. Sellow s.n.* (K, L). BRAZIL. **State unspecified:** *A. F. M. Glaziou s.n.* (NY). **Minas Gerais:** Serra de Piedade, collector unspecified (M no. 496); Santa Luzia, Serra do Cipó, Km 137, road from Conceição do Mato Dentro, 25 Nov. 1938, *M. Barreto 8504* (F), Aug.–Apr. 1840, *P. Claussen* (BR, K), *P. Claussen 2* (R), 1841, *P. Claussen 8* (NY[2]); Serra do Espinhaço, Serra da Piedade near Caeté, along the main road, 16 Sep. 1990, *G. L. Esteves et al. 15440* (W), *Gardner 4995* (GH, K); Serra do Espinhaço, ca. 35 km E of Belo Horizonte, near Highway BR–31, 14 Jan. 1971, *H. S. Irwin et al. 30322* (C, F, NY, UB, US); Serra da Piedade, Nov. 1834, *P. W. Lund s.n.* (C), 18 Feb. 1951, *M. Magalhães 5270* (IAN), *C. F. P. von Martius s.n.* (M no. 57); Ouro Preto, *C. F. P. von Martius s.n.* (M no. 58); Serra da Piedade, 5 July 1986, *J. A. Paula & T. S. M. Grandi 1643* (F), *J. T. Reinhardt s.n.* (C); Itacolomi, *F. Sellow 1064* (US); Serra do Ibitipoca, Pico do Pião, Arenito da Série Lavras, 13 May 1970, *D. Sucre 6777* (CAS, W); Serra da Piedade, 2 Feb. 1866, *E. Warming 108* (C). **Paraná:** Bocaiúva do Sul, Sesmaria, Rio Capivari, 2 km W, 29 Jan. 1969, *G. Hatschbach 20942* (BM, C, F, INPA, K, L, MICH[2], NY[2], S, UC, US); Barras, Rio Taquari, 19 Mar. 1969, *G. Hatschbach 21285* (C, F, GH, K, L, MBM, MO, UC, US, WIS); Piraquara, Serra do Emboque, 9 Mar. 1972, *G. Hatschbach 26534* (C, LL, MBM, MICH, NY, S, UC, US); Morretes, Serra da Graciosa, 27 Apr. 1990, *I. Rauscher gra 18* (U, W); Trilha dos Jesuitas, Quatro Barras, Apr. 1990, *M. Sobral et al. 6213* (MBM[2]). **Rio de Janeiro:** Serra dos Orgãos, Caxambu, 22 Jan. 1887, *A. F. M. Glaziou 16247* (A, BM, BR, K, NY, US); Serra dos Orgãos, Apr. 1888, *A. F. M. Glaziou 17127* (BR, C, F, K, US); Santa Maria Madalena, Parque Estadual do Desengano, Pedra do Desengano, 20 Dec. 1988, *G. Martinelli 13229* (CAS). **Rio Grande do Sul:** Pólo Petroquímico, Montenegro, 8 Nov. 1977, *M. Barreto 1* (RB). **São Paulo:** without collector or locality (M no. 59); Moji-Guaçu, Nov. 1833, *P. W. Lund 728* (C); betw. Jacareí and Moji das Cruzes, *C. F. P. von Martius s.n.* (M no. 55).

Styrax neblinae (Maguire) P. W. Fritsch, stat. nov. Basionym: *Styrax duidae* subsp. *neblinae* Maguire, Mem. New York Bot. Gard. 29: 210. 1978. TYPE: Venezuela. Amazonas: Cerro de La Neblina, Río Yatua, upper basin of Cañon Grande above Salto Grande, 1900–2000 m, 13 Dec. 1957 (fr), *B. Maguire, J. J. Wurdack & C. K. Maguire 42368* (holotype, NY; isotypes, IAN, MO, US).

Habitat, distribution, and phenology. Known only from Sierra de la Neblina and Cerro Aracamuni in extreme southern Venezuela, Amazonas state, in dwarf open thickets and dry forests on sandstone at 400–2100 m; flowering December, January, April, fruiting December.

Originally described as *Styrax duidae* subsp. *neblinae* Maguire, this species differs consistently from *S. duidae* Steyermark by its abaxial leaf surfaces, the white tomentum of which is easily visible through the scattered, 8- to 15-armed ferrugineous stellate trichomes (vs. completely obscured by the densely packed, 18- to 38-armed ferrugineous stellate trichomes). In addition, the drupes of *S. neblinae* are strongly depressed apically, whereas those of *S. duidae* are convex. These differences are at least as great as those between other species of *Styrax* with ferrugineous trichomes on the abaxial surfaces of the leaves that I am recognizing in the treatment of Styracaceae for the *Flora of the Venezuelan Guayana*, such as *S. guanayanus* Maguire

& K. D. Phelps and *S. sipapoanus* Maguire. Therefore, I have elevated *S. duidae* subsp. *neblinae* to the species level.

Additional specimens examined. VENEZUELA. **Amazonas:** Dept. Río Negro, Cerro Aracamuni, summit, Proa Camp, 31 Oct. 1987, *R. Liesner & G. Carnevali 22681* (MO, U); Sierra de la Neblina, Río Yatua, escarpment above Camp 4, 30 Dec. 1953, *B. Maguire et al. 37007* (NY); Sierra de la Neblina, Río Yatua, escarpment edge betw. Cumbre Camp & N Escarpment, 18 Jan. 1954, *B. Maguire et al. 37249* (NY); Sierra de la Neblina, Río Yatua, W of Cumbre Camp, 1–2 Dec. 1957, *B. Maguire et al. 42283* (NY); Dept. Río Negro, Sierra de la Neblina, above Río Marawinuma, E of Puerto Chimo camp, 26 Apr. 1984, *W. Thomas 3237* (CAS).

Styrax nunezii P. W. Fritsch, sp. nov. TYPE: Peru. Cuzco: provincia La Convención, distrito Echarati, E Río Apurimac, NE Pueblo Libre, Anchihuay and Bellavista Mountains, S Cordillera Vilcabamba, 2445 m, 12°51′S, 73°30′W, 3 Aug. 1998 (fl), *P. V. Núñez, W. Nauray, R. de la Colina & S. Udvardy 23320* (holotype, CAS; isotypes, AAU, BR, COL, F, GH, K, LOJA, LPB, MICH, MO, NY, TEX, US, W). Figure 3.

Arbor sempervirens. *Lamina* 7.0–9.3 × 3.5–4.0 cm crassi-chartacea ovata, apice acuminato, subtus pilis densis minutis albi-stellato-tomentosis instructa, magis dispersis sed densis lanatis atro-ferrugineo-stellatis brachiis usque 0.2 mm longis intermixtis, venis quaternariis leviter vel haud elevatis, paginis venarum non manifestis subter indumentum, ubi veteribus pilis ferrugineis absentibus et margine revoluto. *Flos* 10 mm longus; *calyx* 3 × 3–4 mm, dense pallidus fusco-stellato-tomentosus, ad medium brachiis pilorum usque 0.2 mm longis; *stamina* 10; *filamenta* auriculata pilis albi-stellatis undulatis vel aliquantum rigidis brachiis usque 0.8 mm longis instructa; *anthera* 3.5 mm longa loculis lineari-triangularibus ad apicem contractis; *connectivum* locula leviter superante; *stylus* filiformis; *ovula* multa.

Evergreen tree 6 m tall; young twigs densely brown stellate-tomentose. Petiole 10–11 mm long; lamina 7.0–9.3 × 3.5–4.0 cm, 1.8–2.5 times as long as wide, thick-chartaceous, ovate, secondary veins 7 to 10 on each side of midvein; apex acuminate; base broadly cuneate to subrounded; adaxially glabrous except on midrib; abaxially appearing light brown to the naked eye, with a dense base tomentum of minute white stellate trichomes, and more scattered but dense dark ferrugineous woolly stellate trichomes with arms to 0.2 mm long, surface of the veins not visible beneath the pubescence, ferrugineous trichomes often absent on older leaves, tertiary veins slightly raised, quaternary veins faintly or not at all raised; margin entire, revolute on old leaves. Inflorescences axillary or terminal, racemose (or 1- or 2-flowered or rarely paniculate), 1 to 3 per node, 2–3 cm long, 3- to 14-flowered, densely light brown stellate-tomentose; lower pedicels 4–6 mm long. Flowers hermaphroditic, 10 mm long; calyx 3 × 3–4 mm, cupuliform, densely light brown stellate-tomentose, trichomes at mid-calyx with arms to 0.2 mm long, margin truncate between the minute teeth, inner margin eglandular; corolla 9 mm long; tube 1 mm long, extending 1–2 mm beyond the calyx margin; lobes 5, 9 × 1.5 mm, spreading, thickened; stamens 10; free portion of stamen tube none; distinct portion of filaments 1 mm long, ventrally with auricles bearing white, undulating to somewhat stiff stellate trichomes with arms to 0.8 mm long, trichomes nearest the proximal end of the filament with arms predominantly pointing downward, those nearest the distal end with arms predominantly pointing upward, also stellate-pubescent in sinuses of filaments and dorsally, trichomes with arms to 1.3 mm long; anthers 3.5 mm long, the glabrous connectives slightly exceeding the linear-triangular, apically tapered, stellate-pubescent thecae; ovary densely gray-green stellate-tomentose; style filiform, glabrous; ovules many. Fruit unknown.

Habitat, distribution, and phenology. Known only from the type collection (I have only seen flowers, but the specimen label states "young flowres [sic] and fruits") in the cloud forest zone of the Cordillera Vilcabamba in southern Peru; flowering August.

This species resembles *Styrax rigidifolius* Idrobo & R. E. Schultes and several species of *Styrax* from the Guayana Highland, such as *S. guanayanus* and *S. sipapoanus*, in its abaxial leaf surfaces. These are abundantly covered with woolly ferrugineous stellate trichomes in addition to the white stellate base tomentum, rendering the surface light to dark brown to the naked eye. *Styrax nunezii* is easily distinguished from these species, however, by the presence (vs. absence) of auricles on the ventral portion of the stamen filaments. These auricles, as well as the presence of linear-triangular (vs. linear) anthers, allies *S. nunezii* with a group of Andean species with the same combination of features (e.g., *S. pavonii* A. DC., *S. pentlandianus* J. Rémy, *S. peruvianus* Zahlbruckner). No other species of this group is known to have the type of abaxial leaf surface possessed by *S. nunezii*. In addition, the small (10 mm long) flowers and short (2–3 cm) inflorescences are unusual in the group.

The species is named for my colleague Percy Núñez Vargas, curator of Herbario Vargas (CUZ) at the Universidad Nacional San Antonio Abad del Cusco, Cuzco, Peru, who collected the type and

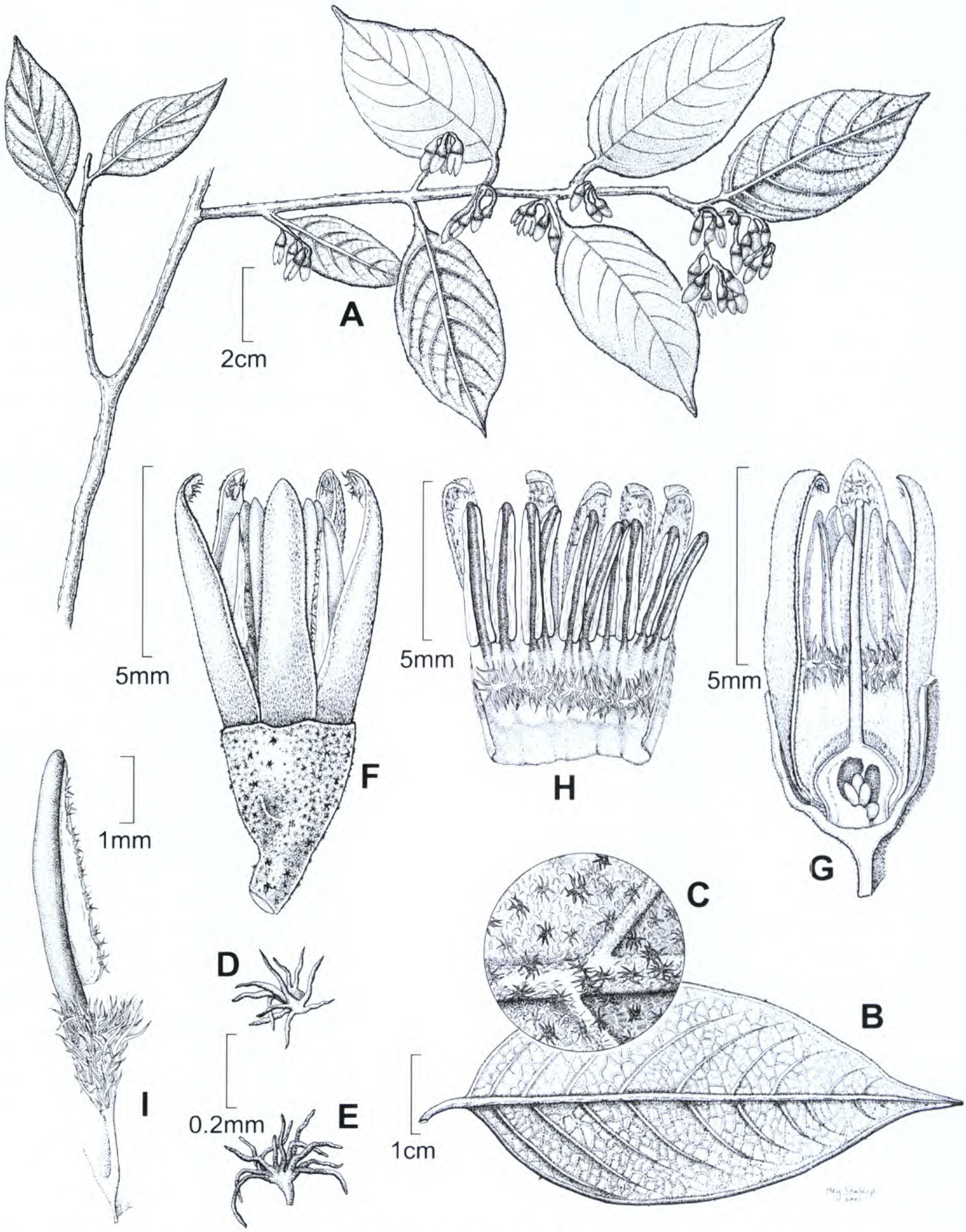

Figure 3. *Styrax nunezii* P. W. Fritsch. —A. Flowering branch. —B. Leaf, abaxial view. —C. Leaf surface, abaxial view. —D. Stellate trichome from the base tomentum of the abaxial side of the leaf. —E. Larger stellate trichome from the abaxial side of the leaf. —F. Flower. —G. Flower, median long-section. —H. Part of corolla + androecium, opened. —I. Stamen, lateral view. Based on the holotype, *Nuñez et al. 23320* (CAS).

generously made specimens available to me for examination. Additional isotypes are to be expected at CUZ and USM.

Styrax rotundatus (Perkins) P. W. Fritsch, stat. nov. Basionym: *Styrax martii* var. *rotundatus* Perkins, Pflanzenr. 4, 241: 40. 1907. TYPE: Brazil. Bahia: Jacobina, *J. S. Blanchet 3614* (lectotype, selected here, BR; isotypes, C, F[2], W; photo of C at F, MICH, MO).

Evergreen shrub to 3(4) m tall; young twigs densely tawny, gray-brown, dark ferrugineous, or brown stellate-tomentose. Petiole (2–)4–8 mm long; lamina 3.3–5.8(–6.6) × 2.1–4.3 cm, 1.3–2 times as long as wide, thick-chartaceous to subcoriaceous, elliptic, ovate-elliptic, ovate, or suborbicular, secondary veins 4 to 8 on each side of midvein; apex acute to subrounded; base broadly cuneate, rounded, truncate, or cordate; adaxially densely brown stellate-tomentose when young, glabrescent except on major veins; abaxially dark ferrugineous or brown to the naked eye, with a dense base tomentum of green-white minute stellate trichomes, and abundant but more scattered woolly ferrugineous trichomes with arms to 0.2–0.3 mm long that are sparse to absent in old leaves, tertiary and quaternary veins distinctly differentiated from one another, distinctly raised, their surfaces visible through the pubescence to completely obscured; margin entire, sometimes revolute. Inflorescences axillary or terminal, racemose or paniculate (axillary inflorescences occasionally 1- or 2-flowered), 1 or 2 per node, 2–6 cm long, 3- to 8-flowered, subtending leaves occasionally strongly reduced, densely gray, dark ferrugineous, or brown stellate-tomentose; lower pedicels 4–7 mm long. Flowers hermaphroditic, 10–13 mm long; calyx 3.5–5 × 2.5–3.5 mm, cupuliform to narrow-cupuliform, densely gray-green stellate-pubescent mixed with larger evenly scattered woolly golden or brown stellate trichomes with arms at mid-calyx to 0.5 mm long, margin truncate between the minute teeth, inner margin eglandular; corolla 8–11 mm long, white; tube 2–3 mm long, extending up to the calyx margin; lobes 5, 5–10 × 0.5–1.5 mm, recurved to reflexed, thin; stamens 10; free portion of stamen tube none; distinct portion of filaments 2 mm long, ventrally without auricles, bearing a dense mass of white stellate trichomes with thin, ± straight arms to 1.5 mm long, trichomes nearest the distal end of the filament with arms predominantly pointing upward, those nearest the proximal end with arms predominantly pointing downward, dorsally glabrous, trichomes along the edges of the filament and at the sinus between filaments with arms to 2 mm long; anthers 3–6 mm long, the glabrous connectives slightly exceeding the linear, apically tapered, stellate-pubescent thecae; ovary densely golden yellow stellate-tomentose; style filiform, glabrous; ovules many. Drupe 5–7 × 4–6 mm, gray-green to dull orange, subglobose, apex slightly to strongly depressed, annular-sulcate around the remains of the style base; wall irregularly and coarsely rugose on herbarium specimens; fruiting calyx 3–5 × 4–6 mm, 0.4–0.8 times the length of the drupe proper.

Habitat, distribution, and phenology. Endemic to Brazil, occurring in the states of Bahia and Minas Gerais in campo rupestre, among rocks, rarely on sandy soil at 900–1850(–?2000) m; flowering November–May, fruiting March–June.

Styrax rotundatus was originally described as a variety of *S. martii* by Perkins (1907; as *S. martii* var. *rotundatus*), who distinguished it from the typical variety by its orbicular leaves with rounded or broad-acuminate apices. In my view, the two taxa differ consistently not only through the shape of the leaves (although more subtly than Perkins has suggested, as indicated in the descriptions herein), but also through numerous other characters that, taken together, have prompted me to recognize *S. martii* var. *rotundatus* at the specific level. The following characters serve to delimit *S. rotundatus* from *S. martii*: petiole (7–)10–19 mm long (vs. (2–)4–8 mm long), lamina 3.3–5.8(–6.6) cm long (vs. 5.9–11.7 cm long), tertiary and quaternary veins distinctly differentiated from each other and conspicuously raised (vs. not well differentiated from each other and moderately raised), lower pedicels 4–7 mm long (vs. 1–5 mm long or nearly absent), calyx 3.5–5 × 2.5–3.5 mm (vs. 5–8 × 4–5 mm), not striate (vs. striate) proximally, flowers 10–13 mm long (vs. 13–18 mm long), corolla tube 2–3 mm long (vs. 5–8 mm long), corolla lobes 0.5–1.5 mm wide (vs. 1.5–2.5 mm wide) and recurved to reflexed (vs. spreading), and drupes 5–7 × 4–6 mm (vs. 9–16 × 6–7 mm), gray-green to dull orange (vs. olive). In addition, *S. rotundatus* is always a shrub, whereas *S. martii* can be either a shrub or a tree; *S. rotundatus* occurs exclusively in campo rupestre vegetation, whereas *S. martii* can occur in campo rupestre but also occurs in forests, forest edges, and campo de altitude. The ranges of the two species are nearly non-overlapping, with *S. rotundatus* occurring from extreme northern Bahia to south-central Minas Gerais, and *S. martii* occurring from south-central Minas Gerais to northern Rio Grande do Sul. The two species are apparently sympatric

only in the Serra do Cipó in south-central Minas Gerais, Brazil.

Perkins (1907) listed two collections in the protologue of *Styrax martii* var. *rotundatus*: *Blanchet 234* and *Blanchet 3614*. I have lectotypified this taxon on the BR specimen of *Blanchet 3614* because it was annotated by Perkins, and because duplicates of *Blanchet 3614* are apparently more widely distributed than those of *Blanchet 234* (I have detected only two sheets of *Blanchet 234*, from P and W, whereas *Blanchet 3614* is housed at BR, C, F, and W).

Additional specimens examined. BRAZIL. **State not specified:** *Glocker 234* (BM (the specimen has the same appearance and is at the same stage of development as collections of *Blanchet 234*; the numeral "*234*" is written on a label separate from another containing the words "Glocker. Brazil. Ex Herb. Shuttleworth.," suggesting that this is actually a duplicate of *Blanchet 234* that has been incorrectly attributed to Glocker)); *C. F. P. von Martius s.n.* (M no. 47). **Bahia:** Jacobina, ca. 24 km from Jacobina to Morro do Chapéu, 28 Oct. 1995, *A. M. A. Amorim et al. 1801* (CAS[3]); Palmeiras, Morro do Pai Inácio, 25 Jan. 1998, *A. M. A. Amorim et al. 2137* (CAS); Utinga, Morro Felix João (Morro da Torre da Embratel), 14 km from Utinga, 16 Mar. 1985, *A. P. de Araújo & W. N. da Fonseca 404* (UB); Morro do Chapéu, 27 Aug. 1980, *H. P. Bautista 414* (K), 5 Apr. 1984, *H. P. Bautista & O. A. Salgado 941* (GUA, MBM, RB), *J. S. Blanchet 234* (P, W); Bomfim, Mount Taboa, 8 May 1918, *H. M. Curran 174* (GH, NY, US); 34 km E of Morro do Chapéu along Highway BA–052, Chapada da Diamantina, 3 Apr. 1976, *G. Davidse et al. 11865* (MO); Morro do Chapéu, 2 Mar. 1997, *F. França et al. 5924* (K, W); 11–13 km from Mucugê along the new Andaraí–Mucugê road, 8 Sep. 1981, *A. Furlan et al. 2120* (K); Rio de Contas, Pico das Almas, 14 Dec. 1984, *A. M. Giulietti et al. 6865* (K), 3 Feb. 1997, *M. L. Guedes et al. 4978* (K); Morro do Chapéu, Highway BA–052, in the direction of Utinga, 8 km from Morro da Torre da Embratel, 30 Aug. 1990, *J. L. Hage et al. 2328* (UB); W of Jacobina, Serra do Tombador, road to Lagoa Grande, 23 Dec. 1984, *R. M. Harley et al. 7471* (K); 20 km N of Lençois on road to Seabra, 14 Feb. 1994, *R. M. Harley et al. 14052* (K, W); Serra do Rio de Contas, Pico das Almas, ca. 25 km WNW of Rio de Contas, 24 Jan. 1974, *R. M. Harley 15476* (K, NY); ca. 6 km N of Barra da Estiva near Rio Preto, 29 Jan. 1974, *R. M. Harley 15651* (K, M, MO, NY, U, US); Serra da Jacobina, W of Estiva, ca. 12 km N of Senhor do Bonfim on Highway BA–130 to Juazeiro, 28 Feb. 1974, *R. M. Harley 16561* (K, M, MO, NY, RB, U, US); 19.5 km SE of the town of Morro do Chapéu on the BA–052 road to Mundo Novo, by the Rio Ferro Doido, 2 Mar. 1977, *R. M. Harley 19270* (AAU, K, MO, NY, U, US); ca. 1 km S of small town of Mato Grosso on the road to Vila do Rio de Contas, 24 Mar. 1977, *R. M. Harley 19913* (AAU, K, NY, U); 15–19 km W of Barra da Estiva on the road to Jussiape, 22 Mar. 1980, *R. M. Harley 20733* (AAU, K, NY, U); Morro do Chapéu summit, ca. 8 km SW of the town of Morro do Chapéu to the W of the road to Utinga, 30 May 1980, *R. M. Harley 22775* (AAU, K, NY, U, US); Piatã, 31 km from Piatã along road to Inúbia, 15 Feb. 1987, *R. M. Harley et al. 24283* (K); Pico das Almas, 19 Feb. 1987, *R. M. Harley et al. 24380* (K), 20 Feb. 1987, *R. M. Harley et al. 24464* (K); Rio de Contas, Mato Grosso, 7 Apr. 1992, *G. Hatschbach 56802* (CTES, F, G, K, MBM, MICH); summit of Morro do Chapéu, ca. 7 km S of the town of Morro do Chapéu, 16 Feb. 1971, *H. S. Irwin et al. 32264* (BM, F, LL, MO, NY, UC, US); Morro do Chapéu, ca. 10 km SW of Morro do Chapéu, 22 Feb. 1993, *J. G. Jardim et al. 59* (CAS, MBM); vicinity of Pico das Almas, ca. 20 km NW of the town of Rio das Contas, 25 Jan. 1981, *L. R. M. King & L. E. Bishop 8661* (MO, US); Palmeiras, Morro do Pai Inácio, BR–242, Km 232, 31 Oct. 1979, *S. Mori 12894* (K, MO, NY); Rio de Contas, Serra das Almas, 5 km NW of Rio de Contas, 21 Mar. 1980, *S. A. Mori & F. Benton 13538* (K, NY); Palmeiras, Morro do Pai Inácio, BR–242 W of Lençois at Km 232, 12 Jun. 1981, *S. A. Mori & B. M. Boom 14380* (NY); Morro do Chapéu, Telebahia Tower, ca. 6 km S of Morro do Chapéu, 16 Jun. 1981, *S. A. Mori & B. M. Boom 14473* (K, NY); Palmeiras, near Caeté Acú, Cachoeira da Fumaça (Glass), 11 Oct. 1987, *L. Queiroz et al. 1909* (MBM, NY); Morro do Chapéu Morrão, Telebahia station, 14 Mar. 1995, *L. Queiroz & N. S. Nascimento 4256* (K, NY), 5 May 1983, *C. T. Rizzini & A. M. Filho 1591* (RB); road from Piatã to Inúbia, ca. 25 km NW de Piatã, 24 Feb. 1994, *P. T. Sano et al. 14489* (K, W[2]); Morro do Chapéu, near Moreira, 31 Mar. 1986, *A. C. Sarmento & H. P. Bautista 842* (GUA, RB); vicinity of Carnaiba, Apr. 1994, *M. Sobral & W. Ganev 7589* (MBM), *Ule 7339* (K, photo of B at F). **Minas Gerais:** Serra do Cabral, ca. 15 km W of Joaquim Felicio, road to Varzea da Palma, 21 May 1990, *M. M. Arbo et al. 4556* (C, CTES, F, MICH); Serra do Cipó, Km 134, 15 Apr. 1935, *M. Barreto 1018* (RB[2], UB); Serra do Cipó, betw. Km 130 & Km 132, 5 Apr. 1951, *G. A. Black & M. Magalhães 51-11889* (IAN); Serra do Cipó, Km 131 & Km 135, 25 Apr. 1950, *A. P. Duarte 2700* (CAS); Joaquim Felício, Serra do Cabral, Armazém da Laje, 16 Mar. 1997, *G. Hatschbach et al. 66308* (CAS); Santana do Riacho, Serra do Cipó, road to Conceição do Mato Dentro, Km 111–112, 26 Jan. 1986, *G. Martinelli 11355* (RB); Botumirim, summit of Serra da Canastra, extreme N, 19 Nov. 1992, *R. Mello-Silva et al. 680* (K, MBM, NY); Jaboticatubas, Km 127 from Lagoa Santa to Conceição do Mato Dentro, 7 Jan. 1973, *J. Semir & A. M. Joly 3802* (NY).

Styrax trichostemon P. W. Fritsch, sp. nov. TYPE: Ecuador. Loja: Loja Canton, Loja–Zamora Highway, 2400–2600 m, 03°58′S, 79°04′W, 23 Dec. 1991, *D. Rubio, C. Aulestia & K. Edwards 2251* (holotype, CAS). Figures 4, 5.

Arbor sempervirens. *Lamina* 5.5–9 × 2.4–3.7 cm coriacea oblanceolata vel oblanceolato-elliptica, apice late obtusa vel rotunda, subtus pilis densis minutis albi-stellatis instructa, magis dispersis sed densis lanatis fulvo- vel ferrugineo-stellatis brachiis usque 0.9 mm longis intermixtis, venis tertiariis et quaternariis prominentibus, paginis venarum tertiariarum et quaternariarum manifestis subter indumentum. *Inflorescentiae* 2–5 cm longae. *Flos* 7 mm longus; *calyx* 2–3 × 2.5–4 mm dense ferrugineo-stellato-tomentosus, ad medium brachiis pilorum usque 0.5 mm longis; *stamina* 10 (usque 12); *filamenta* ventraliter non auriculata ad apicem albi-stellato-tomentosa aliter glabra, brachiis pilorum usque 0.3 mm longis, dorsaliter glabra vel dense stellato-tomentosa; *anthera* loculis glabris linearis ad apicem non contractis connectivum su-

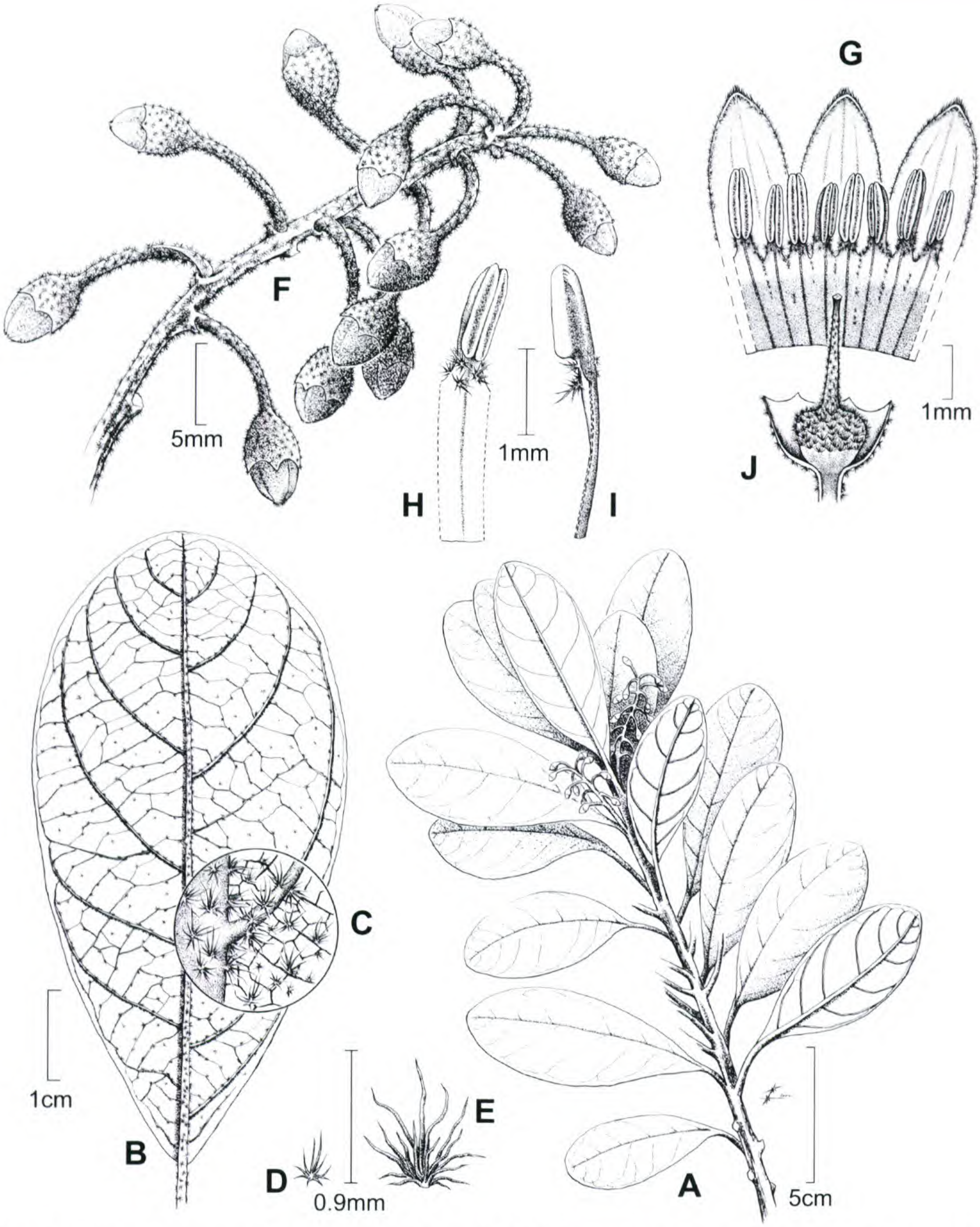

Figure 4. *Styrax trichostemon* P. W. Fritsch. —A. Branch with inflorescences in bud. —B. Leaf, abaxial view. —C. Leaf surface, abaxial view. —D. Stellate trichome from the base tomentum of the abaxial side of the leaf. —E. Larger woolly stellate trichome from the abaxial side of the leaf. —F. Inflorescence in bud. —G. Part of corolla + androecium, opened. —H. Stamen, ventral view. —I. Stamen, lateral view. —J. Calyx, long-section, and gynoecium. A–F based on the holotype, *Rubio et al. 2251* (CAS); G–J based on *Homeier 1026* (CAS).

perantibus; *stylus* subulatus, stellato-lanatus; *placentatio* basalis; *ovula* 3, 1 in quoque carpello.

Evergreen tree 4 m tall; young twigs robust, densely ferrugineous stellate-hirsute. Petiole 9–15 mm long; lamina 5.5–9 × 2.4–3.7 cm, 2.2–3.0 times as long as wide, coriaceous, oblanceolate to oblance-elliptic, secondary veins 6 or 7 on each side of midvein; apex broadly obtuse to rounded;

Figure 5. *Styrax trichostemon* in situ, Zamora-Chinchipe Province, Ecuador. Photograph courtesy of J. Homeier.

base cuneate; adaxially glabrous except on midvein, major veins slightly impressed; abaxially with a dense base tomentum of minute white stellate trichomes, and more scattered but dense tawny to ferrugineous woolly stellate trichomes with arms to 0.9 mm long, the prominently raised, tawny to crimson surface of the tertiary and quaternary veins visible beneath the pubescence; margin entire. Inflorescences axillary or terminal, racemose, 1 per node, 2–5 cm long, 7- to 13-flowered, densely ferrugineous-stellate-hirsute; lower pedicels 5–8 mm long. Flowers 7 mm long; calyx 2–3 × 2.5–4 mm, cupuliform, densely ferrugineous-stellate-hirsute, trichomes at mid-calyx with arms to 0.5 mm long, margin concave between the minute teeth, inner margin glandular; corolla white; lobes 5; stamens 10(to 12); free portion of the stamen tube 0–1 mm long; distinct portion of filaments 0.5–0.8 mm long, planar, ventrally often white stellate-pubescent distally, otherwise generally glabrous, arms of the trichomes to 0.3 mm long, dorsally glabrous to densely stellate-tomentose; anthers 1.1–1.2 mm long, glabrous, the linear, apically non-tapered thecae exceeding the connective. Ovary densely ferrugineous stellate-tomentose; style subulate, stellate-pubescent; placentation basal, ovules 3, 1 per carpel. Fruit unknown.

Habitat, distribution, and phenology. Known only from southern Ecuador in low montane humid forest near the cloud forest zone at 2400–2600 m, flowering October.

This species is clearly recognizable as a distinctive new member of the "gynodioecious" clade (see Fritsch, 1999, 2001), an endemic South American group within *Styrax* series *Valvatae* comprising all species of *Styrax* with five anthers (= *Pamphilia*; Andes and Minas Gerais, Brazil) plus *S. foveolaria* Perkins (Ecuador and Peru) and *S. nui* B. Wallnöfer (Bolivia and Peru). Because only hermaphroditic specimens have been seen by me, it is not known whether any individuals of this species are morphologically gynodioecious. Nonetheless, other features diagnostically place *S. trichostemon* in the gynodioecious clade: small flowers (7 mm long), planar stamen filaments, and a single ovule per carpel.

Results of a phylogenetic analysis based on morphological characters placed *Styrax obtusifolius* Grisebach (Cuba and Hispañiola) as sister to the

remaining members of the gynodioecious clade (Fritsch, 1999). The robust trichomes on the stamen filaments of this species resulted in a phylogenetically nested position of the gynodioecious clade within *S.* series *Valvatae* (the primitive type of trichome on the stamen filaments in the genus is small and delicate, and because the remaining members of the gynodioecious clade have glabrous filaments, they were scored as such in the analysis). In contrast, analyses based on DNA sequence data place the gynodioecious clade as the first-splitting lineage within *S.* series *Valvatae* and *S. obtusifolius* in a highly nested, well supported clade of the series (Fritsch, 2001, 2003). From these analyses it is clear that *S. obtusifolius* and the group comprising the rest of the gynodioecious species of *Styrax* have evolved their small flowers and gynodioecious morphology independently. The exclusion of *S. obtusifolius*, however, has until now left the main gynodioecious group without a clearly identifiable morphological character that corroborates its position in the molecular analyses. *Styrax trichostemon* seems to supply that character in the form of stamen filaments that are pubescent ventrally (for which the species is named) with diminutive trichomes up to 0.3 mm long.

Paratype. ECUADOR. **Zamora-Chinchipe:** Estación Cientifica San Francisco, Loja–Zamora road, ca. 35 km from Loja, 21 Oct. 2001, *J. Homeier 1026* (BIEL not seen, CAS, ECSF not seen, LOJA not seen, MO not seen, QCNE not seen).

Styrax yutajensis (Maguire) P. W. Fritsch, stat. nov. Basionym: *Styrax guanayanus* var. *yutajensis* Maguire (as *S.* "*guanayana* var. *yutajensis*"), Mem. New York Bot. Gard. 29: 207. 1978. TYPE: Venezuela. Amazonas: Serrania Yutajé, Cerro Yutajé, Río Manapiare, NW ridge above Camp Yutajé, 23 Feb. 1953 (fl), *B. Maguire & C. K. Maguire 35394* (holotype, NY; isotypes, IAN, US).

Habitat, distribution, and phenology. Known only from Cerro Yutajé and vicinity, Amazonas state, Venezuela, in dwarf forests on sandstone ridges, rocky areas, and borders of streams at 1300–2100 m; flowering February.

This species was originally described as a variety of *Styrax guanayanus* (as *S. guanayanus* var. *yutajensis* Maguire). It is similar in many respects to *S. guanayanus*: both species have their longer petioles 4–12 mm long, subcoriaceous leaves, abaxially with lateral veins stellate-tomentose and the surface of the veins obscured, lower pedicels 6–10 mm long, inflorescences 3–6 cm long, and a densely and uniformly ferrugineous stellate-tomentose calyx. There are, however, significant differences between the two taxa: *S. yutajensis* has leaf laminae 5.9–7.1 × 2.8–4.1 cm (vs. 8.1–10.0 × 4.8–6.1 cm in *S. guanayanus*), inflorescence branches 0.7–0.9 mm wide (vs. 1.1–1.5 mm wide), reflexed to revolute (vs. spreading) corolla lobes, anthers 6–7 mm long (vs. 3.5–4 mm long), and stamen filaments with stiff, more or less straight (vs. delicate, interwoven) trichomes. The magnitude of these differences is no greater than the difference between other species that I have recognized in the *Flora of the Venezuelan Guayana*. On this basis, I have recognized *S. yutajensis* as a species distinct from *S. guanayanus*.

Additional specimens examined. VENEZUELA. **Amazonas:** Atures, valley of Río Coro-Coro, W of Serrania de Yutajé, 7 Mar. 1987, *B. Holst & R. L. Liesner 3390* (MO, NY); Serrania Yutajé, Río Manapiare, left-hand fork Caño Yutajé, 15 Feb. 1953, *B. Maguire & C. K. Maguire 35241A* [= *34241A*] (MO, NY); Serrania Yutajé, Río Manapiare, Cerro Yutajé, S rim, 15 Feb. 1953, *B. Maguire & C. K. Maguire 35260* (INPA, MO); cliffs to summit, 17–19 Feb. 1953, *B. Maguire & C. K. Maguire 35291* (NY).

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Six New Species of Bolivian *Hibiscus* (Malvaceae)

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ABSTRACT. Six species of *Hibiscus* sect. *Furcaria* (Malvaceae) from Bolivia are described as new, on the basis of character combinations not previously recognized in the group, from a study of the South American representatives of section *Furcaria*. A key is provided to distinguish the 16 species of *Hibiscus* (from all sections of the genus) known from Bolivia.

Key words: Bolivia, *Furcaria*, *Hibiscus*, Malvaceae, South America.

An ongoing study of the species of *Hibiscus* sect. *Furcaria* (Malvaceae) as they occur in South America (Krapovickas & Fryxell, in press) has resulted in the discovery of a number of undescribed South American species. This study is intended to augment the several recent taxonomic studies of this section of *Hibiscus* from various parts of the world (Craven et al., 2003; Menzel et al., 1983; Wilson, 1974, 1993, 1994, 1999; Wilson & Craven, 1995). The present communication presents those new species that are found in Bolivia, to make available the names for the forthcoming *Catálogo de las Plantas Vasculares de Bolivia* (Jørgensen et al., in prep.).

The following six new species of *Hibiscus* all pertain to *Hibiscus* sect. *Furcaria*. Section *Furcaria* is distinguished from the remainder of the large genus *Hibiscus* by distinctive calyx structure, in which the strong lateral ribs on the lobes are positioned on the margins and the midrib is often (not always) furnished with a nectary; it is also distinguished by a distinctive base chromosome number of $x = 18$ (cf. Wilson, 1994). Supporting characters include the often bifurcate elements of the epicalyx or involucel and the presence of foliar nectaries abaxially on one or more of the principal veins of the leaf. The following six new species are distinguished from other similar South American species of *Hibiscus* sect. *Furcaria* by having longer petioles of adult leaves (5 cm or more, rather than 2 cm or less).

Hibiscus adscensionis Fryxell & Krapovickas, sp. nov. TYPE: Bolivia. Santa Cruz: Ñuflo de Chávez, Ascención de Guarayos, 2 km N, 15°40′S, 63°5′W, 2–3 m altura, flores rosadas, orilla de monte, 26 Apr. 1977, *A. Krapovickas & A. Schinini 31722* (holotype, CTES; isotypes, LPB, NY). Figure 1.

Frutex 2–3 m altus, caule villoso pilis stellatis densis. Laminae foliorum pentagonae, base profunde cordata, apice acuto, utrinque pilis stellatis, densioribus pagina inferiori. Bracteolae involucellorum inaequaliter bifurcatae. Calyx hispidus, quam involucellum 1.5-plo longior. Corolla 6–8 cm longa. Fructus pilis stellatis parvis atque pilis simplicibus adpressis.

Shrubs 2–3 m tall; stems densely villous, with yellow, stellate hairs 1.5–2 mm long. Stipules subulate, 10–12 × 1 mm; petioles to 12 cm long and 3–4 mm wide, villous like the stems; leaf blades pentagonal, to 13.5 × 16.5 cm long (from the junction with the petiole), the base deeply cordate, with a sinus up to 6 cm deep, the margins somewhat crenate, the apex acute; reduced in size toward the branch apices, the blade rhomboidal with a serrate margin and on the same branch lanceolate; blade upper surface with primary and secondary nerves barely discernible, with ± erect stellate and some bifurcate hairs, leaving the epidermis visible; blade lower surface with primary and secondary nerves prominent, paler and with denser indumentum than on the rest of the leaf blade, which has hairs similar to those of the stem; nectary single, to 6 mm long, near the base of the midrib beneath. Flowers axillary, solitary, toward the base of the branches, in a leaf axil or on a short flowering branch; peduncle and pedicel combined ca. 2.5 cm long at anthesis, to 5.5 cm long in fruit and very short in the apical buds, articulate in the middle; the basal portion with indumentum similar to that of the stem and

the upper part with small whitish hairs and yellow bifurcate hairs to 3.5 mm long, some of which have a swollen base; bracts of the involucel 10 in number, 11–12 mm long, obscurely and unequally bifurcate; dorsally with rigid bifurcate hairs with the bases enlarged, somewhat larger toward the base and with smaller whitish hairs; the ventral face only with rigid bifurcate hairs; calyx with narrow triangular lobes, 9–10 × 4 mm, at anthesis 15–16 mm long, little if at all accrescent in fruit, with small, soft, whitish hairs, and rigid, yellow, bifurcate hairs ca. 2 mm long with a notably swollen base; nectaries located in the middle of the calyx lobes; corolla 6–8 cm long, reddish; staminal tube 2.5 cm long, with nearly sessile stamens inserted almost to the base; stigmas capitate, 1 mm diam., exceeding the staminal tube by 3 mm. Fruit subequal to the calyx, 12–15 × 12 mm, ovoid, covered by a continuous understory of very small white hairs, surmounted by large, rigid appressed hairs; seeds angular, striate, glabrous, 3.5 mm long.

Vernacular names. "Malva lila," "algodón de la pampa"; in the Tacana language: "yatsi he huapese sha sha."

Geographical distribution. It was initially collected at Ascención de Guarayos in Dept. Santa Cruz, for which reason we name it *Hibiscus adscensionis.* It was subsequently also found in Dept. La Paz.

The additional material, collected in virtually the same locality as the type, has peduncles articulate almost at the base. The terminal inflorescences appear leafless, but consistently have the scars of a leaf and two stipules. *Hibiscus adscencionis* is most similar to *H. conceptionis,* from which it differs in the characters given in the key.

Paratypes. BOLIVIA. **La Paz:** Iturralde, Ixiamas Tacana, 7 July 1995, *Bourdy 1479* (CTES). **Santa Cruz:** 6–12 km E Ascención de los Guarayos on road Aseradero La Chonta on rio Blanco [rio Agua Caliente], ca. 15°45′S, 63°1′W, 10 Aug. 1983, *M. Hopkins & al. 159* (CTES, NY, TEX); Ascención de Guarayos 9 km hacia el este, 30 Aug. 1985, *S. Beck 12289* (CTES, LPB); prov. Ñuflo de Chávez, Cantón Ascensión, Guarayo Este, 24 Sep. 1988, *Coimbra 1* (NY).

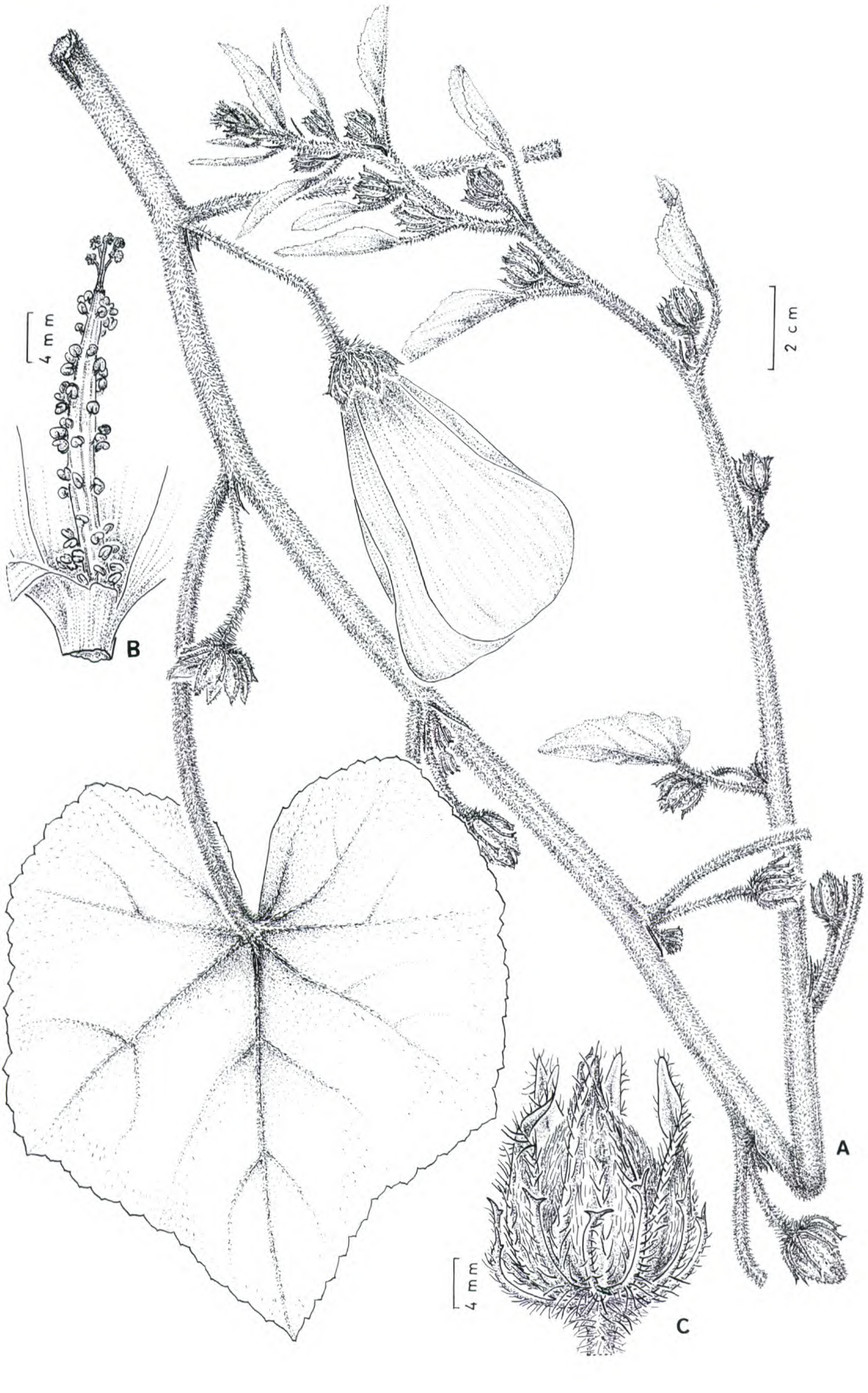
Hibiscus benensis Fryxell & Krapovickas, sp. nov. TYPE: Bolivia. Beni: Vaca Diez, 37 km E of Riberalta on road to Guayaramerín, 11°5′S, 65°45′W, 230 m, 21 May 1982, *J. C. Solomon 7717* (holotype, MO; isotypes, CTES, NY[2]). Figure 2.

Frutex 3 m altus, caule dense pubescenti pilis 0.5 mm longis. Laminae foliorum pentagonae vel leviter 5-lobatae, base cordata, apice acuminato, utrinque pilis stellatis densis. Racemi terminales. Bracteolae involucellorum bifurcatae. Calyx hispidus, quam involucellum 1.5-plo longior. Corolla 7.5 cm longa. Fructus pilis stellatis parvissimis atque pilis simplicibus adpressis 2 mm longis.

Shrubs 3 m tall, the stems densely pubescent, with hairs to 0.5 mm long, sparsely pubescent at the tips of fertile branches revealing the epidermis. Stipules deciduous, subulate, 3–4 mm long, on apical, floriferous nodes; petioles to 5 cm long, densely pubescent; leaf blades pentagonal or slightly 5-lobed, with lateral lobes acute and the central lobe acuminate, the blade (from the insertion of the petiole) 9.5 × 11.5 cm, the base cordate with a sinus 3 cm deep, the margins serrate; the blades reduced in size apically, to triangular with a horizontal base, ultimately diminishing acropetally to a bractiform aspect (almost an absence); blade upper surface with barely noticeable nervation, and with small, dense stellate hairs of ca. 0.5 mm diam.; blade lower surface yellowish, with more prominent, paler primary and secondary nerves, with a cover of very small white scales, and dense, erect, stellate hairs to 1 mm, with somewhat larger stellate hairs with swollen bases on the nerves; nectary solitary, 4–5 mm long, at the base of the midrib beneath, occurring even on the most greatly reduced leaves. Flowers solitary, axillary or grouped, forming an apical raceme; peduncle and pedicel combined 8 mm long at anthesis, to 11 mm long in fruit, articulate toward the base, with indumentum similar to that of the branch apices, with some simple or bifurcate hairs to 1 mm long; bracts of the involucel 9 in number, 8–9 mm long, clearly bifurcate with equal branches, with indumentum similar to that of the peduncle; calyx 13–14 mm long, not accrescent, the lobes 8 × 4–5 mm, triangular, with a dense cover of white scales and hispid with simple or bifurcate hairs 1 mm long with swollen bases, located principally on the primary nerves; nectaries purplish, located on the midribs at the level of the sinuses between the calyx lobes; corolla pale pink, 7.5 cm long; staminal column 3 cm long, with subsessile stamens along the entire length of the staminal column. Fruits subequal to the calyx, with a covering of minute, white stellate hairs, mixed with antrorsely appressed white hairs 2 mm long.

Hibiscus benensis is similar to *H. adscencionis* and *H. conceptionis* but differs in the pentagonal to 5-lobed leaves. It occurs in grassy savanna with shrubs and scattered, gnarled trees.

Paratype. BOLIVIA. **La Paz:** Iturralde, Puerto Muscoso, 190 m, 25 July 1995, *Helme & Kruger 644A* (CTES, LPB).


2 cm
4 mm
B
4 mm
A
C

Hibiscus commixtus Fryxell & Krapovickas, sp. nov. TYPE: Bolivia. La Paz: prov. Iturralde, Luisita, 13°5′S, 67°15′W, 180 m, Sabana húmeda, W del río Beni, 29 Feb. 1984, *S. G. Beck & R. Haase 10120* (holotype, LPB; isotypes, CTES, US). Figure 3.

Frutex ca. 2 m altus, caule pilis stellatis brevissimis sparsis. Laminae foliorum pentagonae, base cordata, apice obtuso vel subacuto, utrinque pilis stellatis erectis. Racemi terminales. Bracteolae involucellorum bifurcatae hispidae. Calyx hispidus, quam involucellum 1.5-plo longior. Fructus pilis stellatis brevis atque pilis simplicibus adpressis.

Shrubs ca. 2 m tall, the stems with small, sparse stellate hairs with horizontal radii, less than 0.5 mm diam., leaving visible the areolate epidermis, denser toward the apices of the branches, sometimes with some isolated, simple, rigid hairs to 1 mm long with swollen bases, and with a longitudinal line of dense, minute, recurved hairs. Stipules narrowly triangular, 5 mm long, somewhat darker and with fewer hairs than the stem; petioles to 9 cm long, with indumentum similar to that of the stem but somewhat denser; leaf blades ± pentagonal, 7 × 10 cm (from the insertion of the petiole), cordate with a sinus 2 cm deep, the apex obtuse to subacute and the margin obscurely crenate; gradually reduced in size toward the branch apices, from ovate to oblong to lanceolate, becoming only 15 mm long including the petiole; blade upper surface with primary and secondary nerves somewhat evident, with a covering of minute white scales with dark centers, with reddish glandular hairs and sparse, erect stellate hairs to 0.5 mm long; blade lower surface with primary, secondary, and tertiary nerves prominent, with somewhat smaller scales and somewhat larger stellate hairs than those of the upper surface; nectary solitary, 3 mm long, at the abaxial base of the midrib. Flowers in few-flowered terminal racemes; peduncle and pedicel combined 1 cm long at anthesis, to 3 cm long in fruit, articulate at the base, with dense pubescence of small, stellate hairs and with abundant simple, rigid hairs 1.5 mm long; involucellar bracts 10 to 11 in number, 12 mm long, arcuate, clearly bifurcate, hispid, with rigid bifurcate hairs with swollen bases, and with small, whitish, stellate hairs; calyx 18 mm long at anthesis, with triangular lobes 8 × 5 mm, with small stellate hairs, with glandular hairs, and on the margins and the central nerve with rigid bifurcate or stellate hairs with swollen bases; nectaries on the lobe midribs at the level of the sinuses between the lobes; in fruit the calyx accrescent to 28 mm long and with a reticulate epidermis; corolla lavender. Fruits 25 × 17 mm, oblong, with a dense cover of small stellate hairs and with rigid, antrorsely appressed hairs 2–3 mm long, these shorter toward the apex of the fruits; internally with long hairs on the lines of dehiscence; seeds 3.5 mm wide, rounded, glabrous.

The name of this species means "mixed" or "mingled" in reference to the combination of characters found in different species. The form of the leaf approximates the group of species related to *Hibiscus pohlii* Gürke and it has the involucel, the accrescent calyx, and the oblong fruit form of *H. furcellatus* Desrousseaux, *H. bifurcatus* Cavanilles, and *H. peruvianus* R. E. Fries. It differs from the widespread *H. furcellatus* in its sparsely (rather than densely) pubescent stems and leaves that are wider than long. It occurs in humid savannas.

Hibiscus conceptionis Fryxell & Krapovickas, sp. nov. TYPE: Bolivia. Santa Cruz: Ñuflo de Chávez, Estancia Novicia, ca. 30 km S de Concepción, 16°29′S, 62°12′W, 500 m, 1 May 1977, *A. Krapovickas & A. Schinini 32114* (holotype, CTES; isotypes, LPB, NY). Figure 4.

Frutex 2 m altus, caule villoso pilis stellatis. Laminae foliorum triangulares base cordata apice acuto vel acuminato, utrinque pilis stellatis, pagina inferiori densioribus. Inflorescentiae terminales. Bracteolae involucellorum non bifurcatae. Calyx hispidus, quam involucellum 1.5-plo longior. Corolla 8 cm longa. Fructus pilis stellatis parvis atque pilis simplicibus adpressis.

Shrubs 2 m tall, the stems villous, with stellate hairs 1–1.5 mm long, denser toward the apices of the branches, where there are also hairs with swollen bases. Stipules filiform, 6–9 mm long, caducous, with stellate hairs 1 mm long, similar to those of the stem; petioles to 6 cm long, with indumentum similar to that of the stem; blades of the basal leaves 7.5 × 9.5 cm, triangular, cordate, the sinus 2 cm deep, the apex acute or acuminate; leaves gradually reduced in size toward the apex of the branches, from cordate to truncate to cuneate; blade upper surface with the nerves scarcely evident, with erect stellate hairs ca. 1 mm long, ± dense but the epidermis visible; blade lower sur-

←

Figure 1. *Hibiscus adscencionis* Fryxell & Krapovickas. —A. Flowering branch. —B. Dissected flower, showing staminal column and styles and stigmas. —C. Immature fruit, showing involucel and calyx. Drawn from *Krapovickas & Schinini 31722* (CTES).

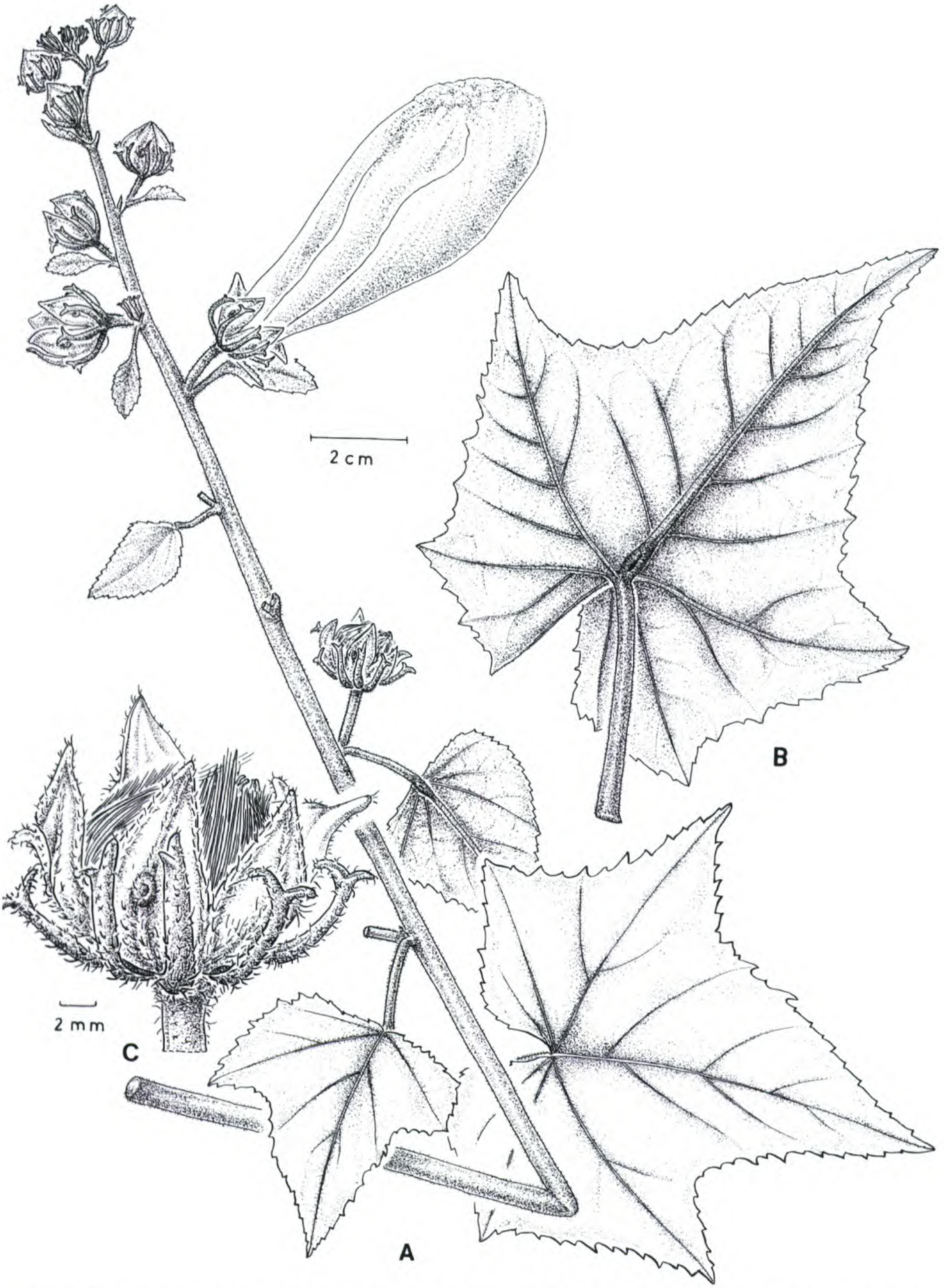


Figure 2. *Hibiscus benensis* Fryxell & Krapovickas. —A. Flowering branch. —B. Abaxial view of leaf. —C. Immature fruit, showing involucel and calyx. Drawn from *Solomon 7717* (CTES).

face with the primary nerves prominent, with pubescence similar but denser; a single nectary toward the abaxial base of the midrib in all leaves regardless of size. Inflorescences terminal, with leaves that diminish in size, ultimately lacking toward the inflorescence terminus; flowers solitary at each node, but toward the base a few short branchlets with 1 or 2 flowers; peduncle and pedicel com-

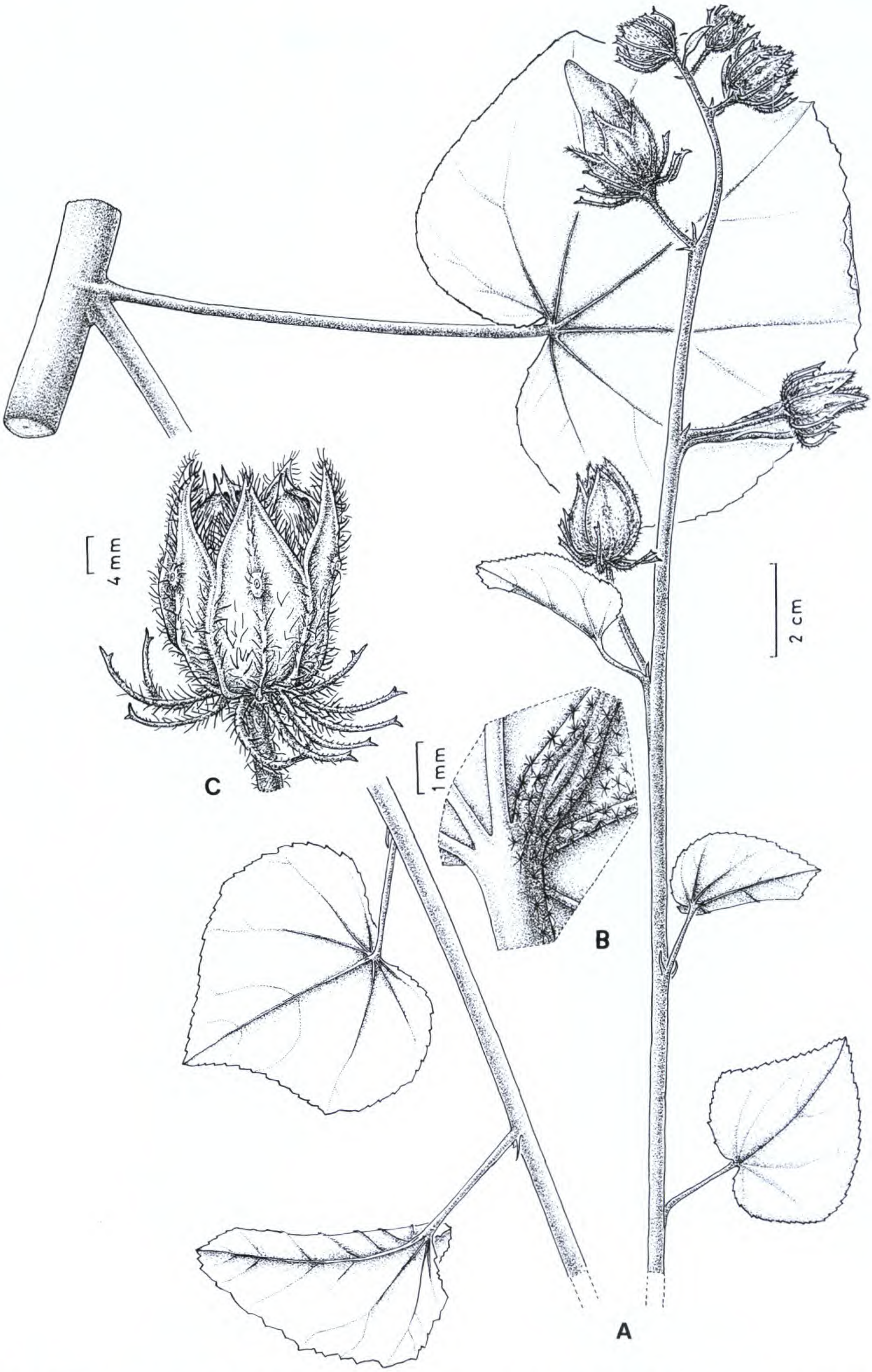


Figure 3. *Hibiscus commixtus* Fryxell & Krapovickas. —A. Flowering branch. —B. Foliar nectary on the abaxial side of leaf blade. —C. Mature fruit, showing involucel and calyx. Drawn from *Beck & Haase 10120* (CTES).

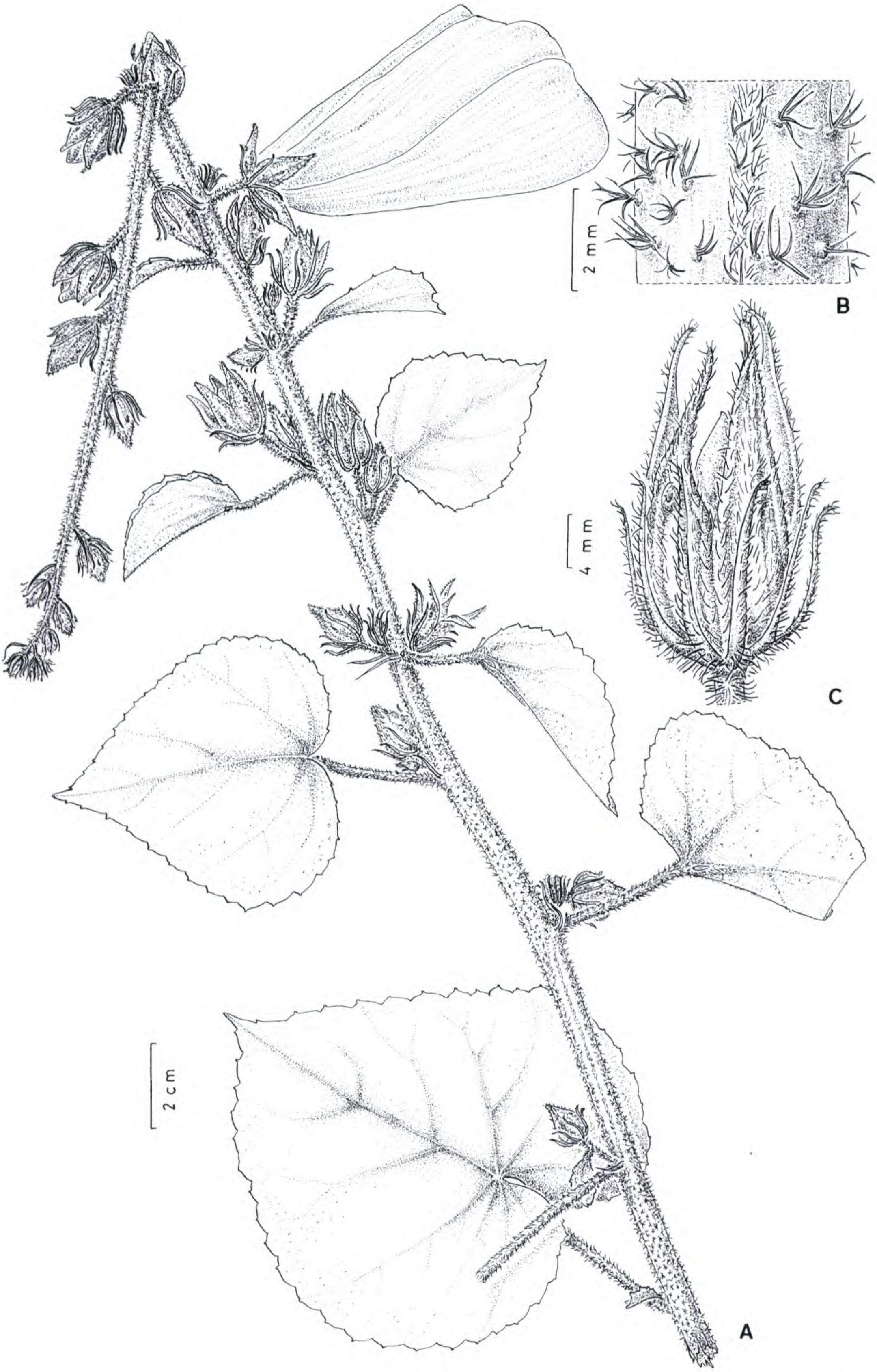


Figure 4. *Hibiscus conceptionis* Fryxell & Krapovickas. —A. Flowering branch. —B. Segment of stem, showing nature of pubescence. —C. Bud, pre-anthesis, showing involucel and calyx. Drawn from *Krapovickas & Schinini 32114* (CTES).

bined ca. 10 mm long at anthesis, accrescent to 25 mm in fruit; articulate near the base, with pubescence similar to stem, but slightly antrorse, intermixed with hairs with swollen bases like those of the bracteoles, also with some smaller, soft, whitish hairs; involucellar bracts 10 in number, 11–14 mm long, filiform, not bifurcate, with a recurved apex, with stellate hairs with enlarged bases that are antrorse and ca. 1 mm long; calyx 18–19 mm long at anthesis to 22 mm in fruit, more than half divided; lobes 16 × 5–6 mm, with hispid indumentum similar to the involucel, with nectaries located above the sinus, in the center of the lobes; corolla 8 cm long, rose-lilac. Fruits subequal to the calyx, ovoid, 16–20 × 11–12 mm, covered with a dense cap of minute hairs and with yellowish hairs ca. 2 mm long, antrorse and appressed, denser apically and on the dorsum of each carpel.

The specific epithet of this species is taken from the fact that the type was collected not far from the city of Concepción, capital of the first section of the province of Ñuflo de Chávez, in Santa Cruz, Bolivia. *Hibiscus conceptionis* is most similar to *H. adscencionis*, from which it differs by the characters given in the key. It occurs on forest margins.

Hibiscus ferreirae Fryxell & Krapovickas, sp. nov. TYPE: Brazil. Mato Grosso: Vila Bela, Posto Indigena Mamaindé, 25 km W de BR-174, km 449 (ca. 82 km SE de Vilhena), 470 m, 21 May 1985, *A. Krapovickas, J. F. Valls, C. Simpson & G. Silva 40148* (holotype, CEN; isotypes, CTES, K, LIL, MBM, NY, SP). Figure 5.

Frutex 2.5–3 m altus, caule pilis stellatis parvis sparsissimis atque lineis longitudinalibus densis pilorum minutorum. Laminae foliorum pentagonae vel leviter 5-lobatae discolores base cordata, apice lobi centralis acuto, pagina superiori pilis sparsis plerumque bifurcatis, pagina inferiori pilis stellatis densioribus, nectario solitario. Inflorescentia ramosa. Bracteolae involucellorum simplices. Calyx pilis hispidis brevis, quam involucellum duplo longior. Corolla 6–9 cm longa. Fructus oblongus pilis stellatis parvissimis atque pilis simplicibus adpressis 2 mm longis.

Shrubs 2.5–3 m tall, the stems with small, very sparse stellate hairs to 0.5 mm long, and with very narrow longitudinal lines of dense minute hairs. Stipules filiform, to 5 mm long, deciduous; petioles to 16.5 cm long, the indumentum somewhat denser than that of the stem, made up of stellate hairs to 1 mm long and with a longitudinal line of smaller denser hairs; leaf blades discolorous, to 16 × 20 cm (from the insertion of the petiole), the base cordate with a sinus 5 cm deep, the margin crenate, pentagonal to weakly 5-lobed, the central lobe acute to acuminate; in the apical inflorescence the leaves progressively reduced in size, becoming triangular with a truncate base, to lanceolate and only 1 cm long, including the petiole; blade upper surface with primary and secondary nerves somewhat evident, with sparse, simple, bifurcate, or sometimes stellate hairs 1 mm long; lower blade surface yellowish, with prominent primary and secondary nerves (paler than the tertiary nerves), with stellate hairs similar to those of the upper surface but denser; nectary solitary, 5–9 mm long, on the adaxial base of the midrib. Inflorescences branched and apical, with solitary flowers whose base has a floriferous branchlet to 15 cm long; peduncle and pedicel combined ca. 10 mm long at anthesis to 20 mm in fruit, articulate toward the base, somewhat accrescent, densely puberulent, with sparse, rigid, simple or bifurcate hairs 0.5 mm long; bracts of the involucel 9 in number, 6–7 mm long, slender, simple, with the apex somewhat recurved, with indumentum similar to that of the petiole; calyx not accrescent, 15 mm long, twice as long as involucel, the lobes triangular, 8 × 5 mm, puberulent with very few rigid, simple or bifurcate hairs 0.5 mm long on the nerves; nectary located on the central nerve a little above the sinus between the lobes, slightly swollen; corolla pink, 6–9 cm long. Fruit oblong, slightly exceeding the calyx, 16–17 mm long, with a covering of minute white stellate hairs, with appressed, antrorse hairs 2 mm long; seeds 4 mm long, angulate, glabrous, and striate.

We dedicate this species to the Portuguese botanist Alexandre Rodrigues Ferreira (1756–1815), who illustrated it in his unpublished work *Viagem Filosofica*, plate 67 (Bibl. Nac. Rio de Janeiro), an account of his trip to Amazonia between 1783 and 1792. On reconnoitering the Río Iténez [or Guaporé] from Belém to Cuiabá, Ferreira observed this species, of which he made a drawing with details sufficient for its identification as the species here described. It occurs in cerrado vegetation and on river banks.

Paratypes. BOLIVIA. Velasco, Estancia Flor de Oro, W side of Río Guapore (= Río Iténez), 13°33′S, 61°0′W, 28 June 1991, *M. Nee 41493* (CTES, NY, TEX, WIS); Velasco, Parque Nacional Noel Kempff M., Los Fierros, 200 m, 30 June 1993, *M. Saldias et al. 2808* (CTES, SCZ). BRAZIL. **Rondônia:** Riozinho, BR-364, 23 May 1985, *A. Krapovickas et al. 40168* (CEN, CTES, NY); Pimenta Buena, BR 364, km 188, 10 June 1984, *C. Cid et al. 4650* (K). **Mato Grosso:** Dardanelos, Rio Aripuaña, Clareira Jurema, 13 June 1974, *I. Cordeiro 25* (CTES); Pontes e Lacerda, MT 246, estrada para Vila Bela, 18 July 1986, *Emmerich 5718* (CTES, R).

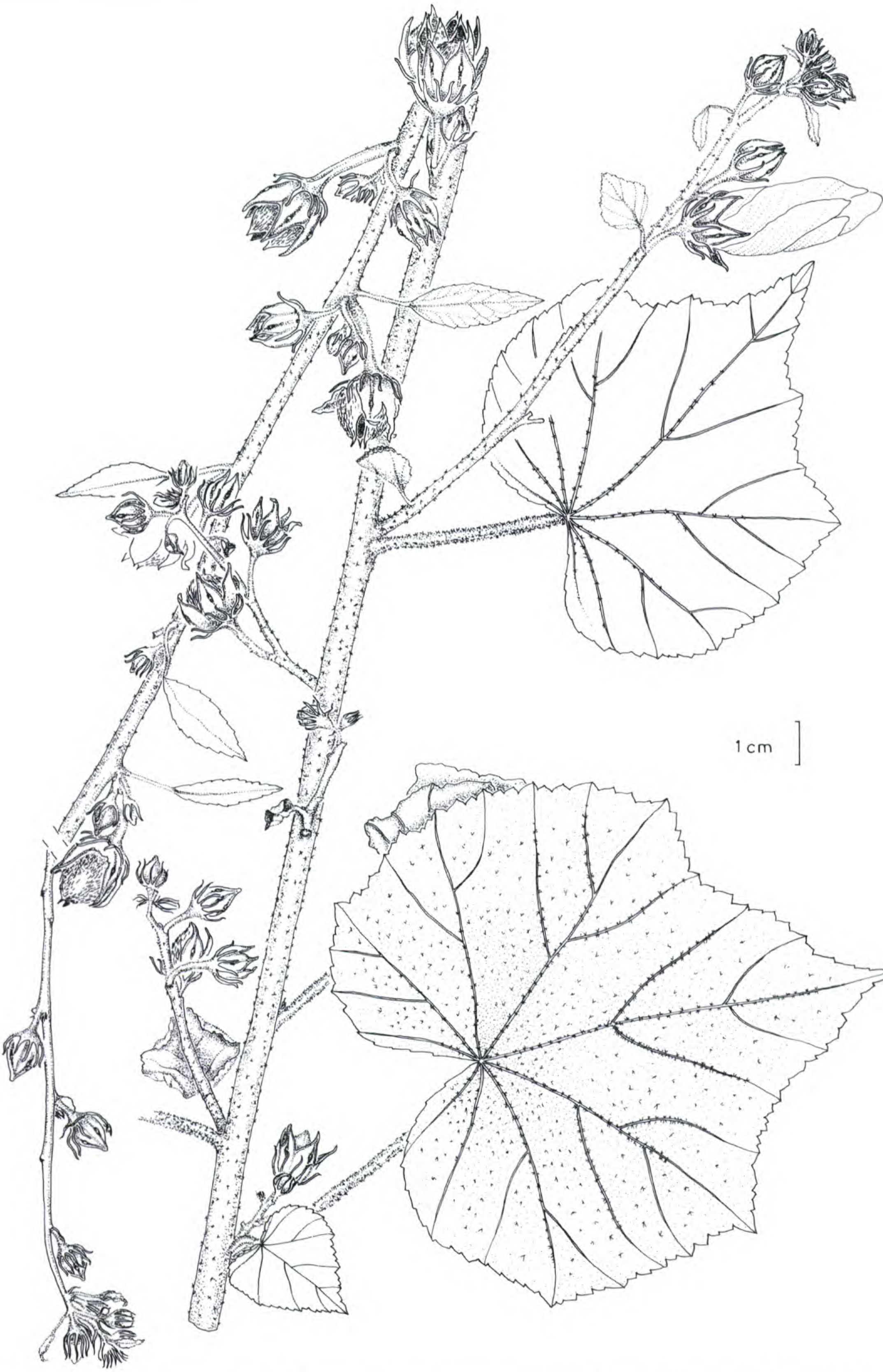


Figure 5. *Hibiscus ferreirae* Fryxell & Krapovickas. Flowering and fruiting branch. Drawn from *Krapovickas et al. 40148* (CTES).

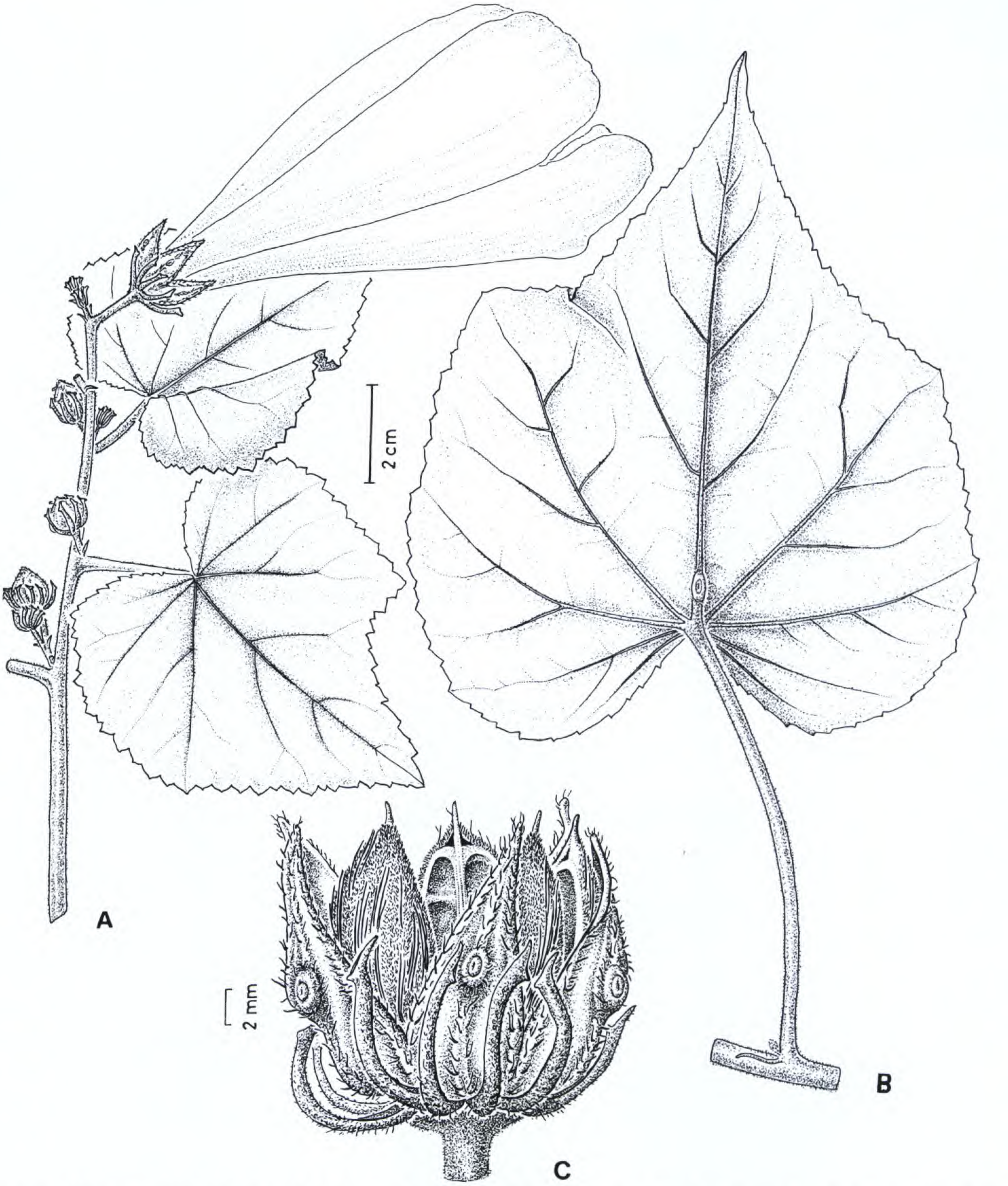


Figure 6. *Hibiscus paludicola* Fryxell & Krapovickas. —A. Flowering branch. —B. Abaxial view of leaf. —C. Mature fruit, showing involucel and calyx. Drawn from *Krapovickas et al. 40211* (CTES).

Hibiscus paludicola Fryxell & Krapovickas, sp. nov. TYPE: Brazil. Mato Grosso: 3.5 km SE de Barra do Bugres, camino a Cuiabá, 1 June 1985, *A. Krapovickas, J. F. Valls, C. Simpson & G. Silva 40211* (holotype, CEN; isotypes, CTES, K, MBM, NY). Figure 6.

Frutex 2 m altus, caule dense puberulo. Laminae foliorum pentagonae vix 3–5-lobatae base cordata, apice acuto utrinque pilis stellatis parvis, nectario solitario. Bracteolae involucellorum simplices vel vix bifurcatae. Calyx hispidus quam involucellum 1.6-plo longior. Corolla 8.5–9.5 cm longa. Fructus pilis parvis albis atque aliquot pilis simplicibus adpressis 2 mm longis.

Shrubs 2 m tall, the stems densely puberulent, with small stellate hairs to 0.5 mm. Stipules subulate, to 9 × 1 mm at the base; petioles to 10 cm long, with indumentum similar to stems; leaf blades to 12 × 11.5 cm (from the insertion of the petiole), pentagonal, weakly 3- to 5-lobed, the central lobe triangular, acute, the margin crenate-serrate, the base cordate with an open sinus 2 cm deep; blade

size diminishing acropetally to lanceolate and 1 cm long, including the petiole; blade upper surface with primary and secondary nerves somewhat prominent, with small, dense stellate, bifurcate, and a few simple hairs, less than 0.5 mm long; blade lower surface with the primary and secondary nerves prominent, pallid, with indumentum similar to that of the upper surface, but with somewhat longer hairs; nectary solitary, 5–6 mm long, near the base of the midrib. Flowers axillary, the peduncle and pedicel combined 8 mm long at anthesis, to 18 mm in fruit, articulate near the base, with indumentum similar to that of the stem; involucellar bracts 10 in number, 10 mm long, simple or with bifurcation barely indicated, with indumentum similar to that of the peduncle, and with some longer hairs on the margin; calyx not accrescent, 16 mm long, with triangular lobes 8 × 6 mm, densely puberulent between the ribs, these hispid, the hairs to 1.5 mm long; nectaries located just above the sinus between the lobes, on the central nerve of each lobe, not swollen; corolla pink, 8.5–9.5 cm long; staminal column 4 cm long with subsessile stamens at discrete levels along the entire length of the tube; stigmas exceeding the staminal tube by some 10 mm. Fruits subequal to the calyx, 15 × 15 mm, with a covering of minute, white stellate hairs, and with some yellowish simple hairs ca. 2 mm long, appressed and antrorse; seeds 5 mm long, angulate, striate, and with very small pectinate scales.

The name of this species alludes to its preference for flooded habitats.

Paratypes. BOLIVIA. **Santa Cruz:** Velasco, Parque Nacional Noel Kempff M., Cerro Pelao, 14°32′S, 61°29′W, 230 m, 25 jul. 1993, *R. Quevedo et al. 1107* (CTES, USZ). **Beni:** Yacuma, El Mirador, 1 km hacia Aguas Claras, sobre el río Benecito, 1160 M, 19 sep. 1933, *S. Beck & de Michel 20880* (CTES, LPB). BRAZIL. **Mato Grosso:** Pontes e Lacerda, Serra da Borda, 13 July 1985, *Souza 1279* (R). **Rondônia:** 7 km adentro de entroncamento a 10 km de Costa Marques, sentido de Rolim de Moura, 28 May 1990, *Skorupa et al. 830* (CEN, CTES). **Amazonas:** "Estrada do Estanho," road to Igarapé Preto, 60–62 km SE of Transamazon Hwy., 3 July 1979, *Calderón et al. 2757* (K, US); Humaita, fazenda do Flávio Ner, ao Sul da BR 319, km 658, 14 May 1980, *Janssen & Gemtschujnicov 383* (M).

Key to Bolivian Species of *Hibiscus*

1a. Calyx lobes with prominent ribs located on the margins and with midribs bearing a centrally located nectary; involucellar bracts sometimes bifurcate [sect. *Furcaria*].
  2a. Calyx and involucel finely puberulent; lateral ribs of adjacent calyx lobes not uniting below the sinus; fruits oblong . . . . . *Hibiscus peruvianus* R. E. Fries
  2b. Calyx ± hispid; lateral ribs of adjacent calyx lobes uniting at the sinus; fruits usually ovoid (except oblong in *H. furcellatus* and *H. commixtus*).
    3a. Foliage reddish, essentially glabrous; in cultivation . . . . . *Hibiscus acetosella* Welwitsch ex Hiern
    3b. Foliage green, ± pubescent (except glabrescent in *H. bifurcatus*); indigenous, commonly growing in wet habitats.
      4a. Plants sparsely aculeate, eventually glabrescent; leaves 3(to 5)-lobed; involucel exceeding the calyx at anthesis, the bracts notably bifurcate . . . . . *Hibiscus bifurcatus* Cavanilles
      4b. Plants variously pubescent but not aculeate; leaves unlobed or only weakly lobed; involucel shorter than calyx at anthesis, the bracts bifurcate or simple.
        5a. Calyx accrescent in fruit; fruits oblong; involucellar bracts manifestly bifurcate.
          6a. Stems densely stellate-pubescent, rarely also with a few hispid hairs; leaves angulate to weakly lobed, usually longer than wide . . *Hibiscus furcellatus* Lamarck
          6b. Stems sparsely and minutely stellate-pubescent; leaf blades wider than long . . . . . *Hibiscus commixtus* Fryxell & Krapovickas
        5b. Calyx not accrescent; fruits ovoid; involucellar bracts simple or barely bifurcate.
          7a. Inflorescence terminal and branched (paniculoid).
            8a. Stems densely puberulent; calyx puberulent but ribs hispid, these hairs to 1.5 mm long . . . . . *Hibiscus paludicola* Fryxell & Krapovickas
            8b. Stems sparsely puberulent; calyx puberulent only, the hairs on the ribs to 0.5 mm long . . . . . *Hibiscus ferreirae* Fryxell & Krapovickas
          7b. Inflorescence terminal and unbranched (racemoid).
            9a. Leaves often 5-lobed; involucellar bracts clearly bifurcate with equal branches . . . . . *Hibiscus benensis* Fryxell & Krapovickas
            9b. Leaves obscurely lobed or merely angulate.
              10a. Bracts of involucel unequally bifurcate; stems densely hirsute; fruits 12–15 mm long . . . . . *Hibiscus adscensionis* Fryxell & Krapovickas
              10b. Bracts of involucel simple; stems sparsely hirsute; fruits 16–20 mm long . . . . . *Hibiscus conceptionis* Fryxell & Krapovickas

1b. Calyx lobes with lateral ribs located away from the margins and lacking calyx nectaries; involucellar bracts never bifurcate [sections other than *Furcaria*].

11a. Bracts of involucel abruptly dilated to a reniform blade at apex; capsules globose to oblong, densely hispid, the hairs 2–3 mm long . . . . . *Hibiscus sororius* L.
11b. Bracts of involucel linear or lanceolate, sometimes (*H. schizopetalus*) greatly reduced; capsules oblong-ovoid to ovoid, variously pubescent.
12a. Leaves narrowly lanceolate or hastate (2–3 × as long as wide); bracts of involucel 10–12, hispid; styles and stigmas connate, the stigmatic zone a white 5-lobed disk; capsules oblong-ovoid, densely hispid, the hairs 3–5 mm long . . . . . *Hibiscus striatus* Cavanilles
12b. Leaves ± ovate (1–2 × as long as wide) or rhombic; bracts of involucel ca. 8, ± glabrous; stigmas distinct, the styles apically divergent; capsules ovoid (or seldom produced in *H. rosa-sinensis* and *H. schizocarpus*).
13a. Leaf blades as wide as long, 8–17 cm long; stems pubescent; flowers often aggregated apically . . . . . *H. mutabilis* L.
13b. Leaf blades longer than wide, often smaller than 8 cm long or wide; stems glabrous or glabrescent; flowers usually axillary.
14a. Leaf blades rhombic to weakly 3-lobed; calyx 1–1.5 cm long, minutely puberulent; petals 3–4 cm long; involucel subequal to calyx . . . . . *H. syriacus* L.
14b. Leaf blades ovate to lanceolate; calyx 1.5–4 cm long, essentially glabrous; petals 5–10 cm long; involucel shorter than calyx.
15a. Flowers ± erect, the pedicels shorter than the subtending leaves; petals erect, entire or slightly erose; involucel 1–2 cm long . . . . . *Hibiscus rosa-sinensis* L.
15b. Flowers pendent, the pedicels exceeding the subtending leaves; petals reflexed, complexly dissected; involucel minute (to 2 mm) . . . . . *Hibiscus schizopetalus* (Dyer) Hooker

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Dacryophyllum falcifolium, a New North American Genus and Species (Musci: Hypnaceae) from California

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ABSTRACT. *Dacryophyllum falcifolium*, a new North American genus and species of moss, is described and illustrated. The taxon is described from sterile California collections, where it occurs on calcareous rock in redwood forests in Monterey and Santa Cruz Counties. The new moss genus *Dacryophyllum* is considered a member of the large pleurocarpous family Hypnaceae and is morphologically close to *Taxiphyllum*.

Key words: California, *Dacryophyllum*, Hypnaceae, Musci, North America, *Taxiphyllum*.

Four collections of an unknown moss growing on calcareous substrates from three different localities in the redwood forests of Monterey and Santa Cruz Counties, California, located in the central coastal part of the state, recently were made by Kenneth M. Kellman and sent to me for identification. An examination of the four collections revealed that the plants have several distinctive features that show a relationship to the genus *Taxiphyllum* Fleischer, a member of the family Hypnaceae. Similarities in the plants' color, growth habit, branching pattern, leaf arrangement, costa features, leaf shape, leaf margins, leaf cell prorations, and presence of foliose stem pseudoparaphyllia all indicate a close relationship with some members of the Hypnaceae, especially *Taxiphyllum*. However, several of its morphological characters are sufficiently different to justify describing a new genus and species. The species is easily recognized by its small size (plants to 1.5 cm), its complanate-foliate, prostrate stems, its broadly falcate leaf apices, its usual lack of a costa or a short, indistinct double one, its short, broad apical leaf cells (shorter and broader than in most North American *Taxiphyllum* species), its basal row of leaf cells at the stem insertion with large prorulae at their proximal ends, and its foliose, serrulate to toothed pseudoparaphyllia, sometimes with single-celled, large teeth, usually mixed with entire filamentous pseudoparaphyllia. The calcareous substrate upon which it grows is also a clue to its recognition. The publication of this new genus is essential for the forthcoming Bryophyte Volume 28 of the *Flora of North America*.

Dacryophyllum falcifolium Ireland, gen. et sp. nov. TYPE: U.S.A. California: Santa Cruz Co., cliff on opposite side of South Fork Fall Creek from Blue Cliff, above Lime Kilns, Fall Creek Division, Henry Cowell Redwoods State Park, near Felton, ca. 37°03′30″N, 122°05′45″W, 244 m, on vertical face of calcareous rock in woods, 12 June 1999, *K. M. Kellman 704* (holotype, CAS; isotypes, DUKE, MO, NY, UC, US). Figure 1.

In ramis complanate foliatis in pseudoparaphylliis anguste foliosis in nervis caulis centralis nullis et in foliis falcatis laevibus ecostatis in cellulis numerosis basilaribus juxta caulem retroprorulis et margine inferne saepe binate denticulatis distinctum.

Plants in thin mats, complanate-foliate, light- to yellow-green, glossy; stems to 1.5 cm, 0.8–1.0 mm wide, prostrate, simple or sparingly and irregularly branched, cortical cells moderately small, thick-walled, in 2 or 3 rows, central cells large, thin-walled, central strand lacking; rhizoids few, smooth, ventrally inserted, single or in clusters below leaf insertion; axillary hairs ca. 108 μm long, mainly in axils of uppermost leaves near apical bud, consisting of 1 short brown basal cell and 1 or 2 elongate hyaline distal cells; pseudoparaphyllia narrowly foliose, 2 to 4 cells wide, serrulate to toothed, sometimes with single-celled, large teeth, usually mixed with some entire filamentous pseudoparaphyllia, 3 to 6 cells long, branch primordium not evident among pseudoparaphyllia. Stem and branch leaves similar, stiff, appressed-imbricate, flat, smooth, asymmetric, 0.3–0.5 × 0.1–0.2 mm, oblong-lanceolate, acute to obtuse, falcate, margins plane, serrulate, becoming serrate at leaf base, serrations often formed by two basal cells abutting, broadly incurved on one side at base, nondecurrent; costa lacking or indistinctly double; cells thin to moderately thick-walled, linear-flexuose to rhomboidal, especially near leaf apex, smooth or often with mi-

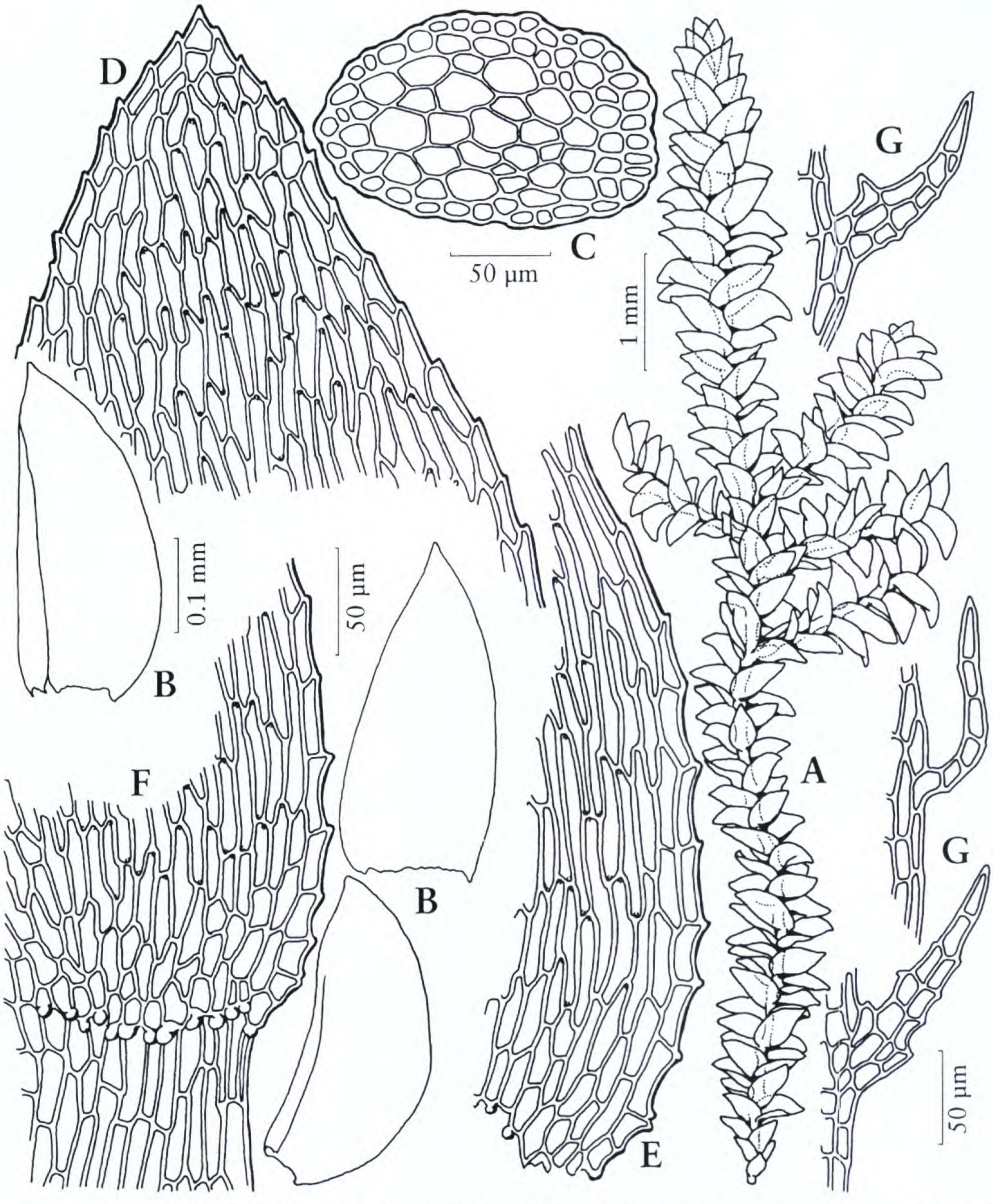

Figure 1. *Dacryophyllum falcifolium* Ireland. —A. Habit. —B. Leaf outlines. —C. Stem cross section. —D. Apical leaf cells on abaxial surface. —E. Basal-marginal leaf cells on abaxial surface showing serrations (note serration formed by abutting cells just above E). —F. Basal leaf cells on abaxial surface showing large prorulae on proximal ends of cells at stem insertion. —G. Pseudoparaphyllia (note large tooth on uppermost pseudoparaphyllium). Drawn by P. M. Eckel from isotype (US).

nute prorulae on abaxial surface at distal and proximal ends, prorulae sometimes more prominent on basal cells, with walls nonpitted; median cells 32–45 × 4–5 µm; apical cells 10–28 × 5–7 µm; basal row of cells at stem insertion each with a large prorula at proximal end on the abaxial surface; alar cells 8–19 × 6–7 µm, quadrate to rectangular, in 1 to 4 rows with 2 to 7 cells in marginal row. Asexual reproductive bodies lacking. Plants sterile, sex organs unknown.

Etymology. The genus name is derived from the Greek *dakryo*, meaning to shed tears or weep, and *phyllon*, meaning leaf, referring to the basal leaf cells at stem insertion with proximal prorulae on the abaxial surface (Fig. 1F) giving the appearance of tears, and the downward-pointing leaf apices adding to the weeping meaning (Fig. 1A). The species epithet is from the Latin *falcis*, meaning sickle, and *folium*, meaning leaf, referring to the sickle-shaped leaf apices of the plant (Fig. 1B, lowest leaf outline).

Distribution and habitat. Endemic to California. The collections were made in Coast Redwood forests on vertical surfaces of shaded, calcareous rock cliffs and rock outcrops at elevations of 50–244 m. According to the type collector the localities have a typical Mediterranean climate, with a dry, warm summer and a cool, rainy winter, which is generally from October to April. The common trees at the sites are *Sequoia sempervirens* (D. Don) Endlicher, *Acer macrophyllum* Pursh, and *Lithocarpus densiflorus* (Hooker & Arnott) Rehder. The mosses associated with *Dacryophyllum* are *Brachythecium* species, *Didymodon* species, *Fissidens crispus* Montagne, and *Isothecium myosuroides* Bridel.

Morphology and relationship. Dacryophyllum falcifolium is primarily distinct because of its prostrate small-sized plants, stems to only 1.5 cm long and 0.8–1.0 mm wide (Fig. 1A), its small, complanate-foliate leaves, 0.3–0.5 mm long, with acute to obtuse leaf apices, usually strongly falcate (Fig. 1B), and its serrulate to serrate leaf margins (Fig. 1D–F). The basal cells on the margins in the alar region often have two abutting cells forming a serration similar to the basal serrations in the pleurocarpous moss *Conardia compacta* (J. K. A. Müller) H. Robinson (Crum & Anderson, 1981) and those on the leaf margins of several species of the acrocarpous moss *Philonotis* (Fig. 1E, just above letter). The apical leaf cells are noticeably short and broad, 10–28 × 5–7 μm (Fig. 1D). The leaf cells have minute prorulae on the abaxial surface on the distal ends of the cells or sometimes at both ends (Fig. 1E). The costa is usually lacking or indistinct and short and double. The basal row of leaf cells at stem insertion is unique because of the large prorulae at the proximal ends on the abaxial surface (Fig. 1F). One other unique feature is the narrowly foliose, 2 to 4 cells wide, serrulate to toothed pseudoparaphyllia, sometimes with a single-celled, large tooth (Fig. 1G, uppermost pseudoparaphyllium), usually intermixed with filamentous entire pseudoparaphyllia, 4 to 6 cells long (Fig. 1G, middle pseudoparaphyllium).

Plants of the holotype (*Kellman 704*) and one paratype (*Kellman & Shevock 2671*) were sent to A. J. Shaw (DUKE) who conducted a DNA test on a single chloroplast gene from plants of the two specimens in order to see how the unknown California moss was related to many other pleurocarpous moss species he had tested in the past. The sequencing was done on the *trn*L-*trn*F region (Taberlet et al., 1991). He admitted (pers. comm.) that "a single chloroplast gene doesn't give much useful resolution, especially in the Hypnales, where species, genera, and even some families are extremely closely related in a genetic sense." The two specimens he tested yielded identical sequences. The closest species that it came to in his DNA test was *Hypnum pallescens* (Hedwig) P. Beauvois, which as he stated "gives some support to the Hypnaceae idea" where I thought the species belonged. However, it is not very close morphologically to *Hypnum pallescens* or to any other species of *Hypnum*. *Hypnum* taxa often have stems that are regularly pinnate, leaves that are often falcate-secund, standing out from the stems, with acuminate to long-subulate apices, apical cells that are elongate, and the pseudoparaphyllia on the stems are usually broadly foliose, with or without teeth or with ciliate margins.

I originally intended to describe this unknown moss as a *Taxiphyllum*, a member of the Hypnaceae that I have worked on for several years. However, I had some reservations and wanted to confirm its generic position, so I sent some of the holotype and one of the paratype (*Kellman & Shevock 2671*) specimens to William R. Buck (NY), an authority on the pleurocarpous mosses. He thought (pers. comm.) the genus was close to the family Neckeraceae, which has many genera with a somewhat similar appearance and morphology. *Isodrepanium lentulum* (Wilson) Britton, e.g., has a superficial similarity with its smooth, falcate, cultriform leaves, but it differs in many important microscopic morphological features, especially the lack of large prorulae on the abaxial surface at the proximal ends of the basal cells at the stem insertion. Other taxa in the Neckeraceae have rhombic to rhomboidal leaf cells, usually without prorulae, and sometimes paraphyllia are present or the pseudoparaphyllia that are present in some species are narrowly foliose with entire margins. He excluded the plants from *Taxiphyllum* because (1) the plants, especially those from North America, were too small (*Taxiphyllum* in Asia, however, can be very small, e.g., *Taxiphyllum arcuatum* (Bosch & Sande Lacoste) Si He); (2) the pseudoparaphyllia had large teeth, composed of almost whole cells (rather than serrulate with only cell ends projecting); and (3) the most important reason was the cells at the leaf in-

sertion with the stem were strongly prorulose at their proximal ends on the abaxial surface and project down from the leaf base. He stated that he had not seen leaf insertion cells of that type before. It was the presence of prorulose cells at the leaf insertion that prompted me to seek the opinion of two other bryologists, namely Lewis E. Anderson (DUKE) and Harold E. Robinson (US). Both (pers. comm.) thought the plants should be described as a new genus because of major differences with *Taxiphyllum*, especially because of the unique prorulose cells at the leaf insertion first observed by Buck, who also was in favor of recognizing it as a new genus.

The plants of *Dacryophyllum falcifolium* are somewhat close in appearance to some species in the genus *Taxiphyllum*; both genera grow on calcareous substrates and share some common morphological characteristics. The similarities are the green or yellow-green, glossy, prostrate, mostly complanate-foliate, simple or sparingly branched plants, the leaves that are nondecurrent often with serrulate to serrate margins, sometimes with obtuse apices, the costa that is almost lacking in *Dacryophyllum* and sometimes so in *Taxiphyllum*, the abaxially prorate leaf cells with the prorulae very prominent at the distal cell ends in *Taxiphyllum*, present but usually minute in *Dacryophyllum*, and the presence of foliose pseudoparaphyllia. *Dacryophyllum* is distinguished by the falcate leaf apices, the lack of a central strand of cells in the stem, and the pseudoparaphyllia that are much narrower than in *Taxiphyllum* (Ireland, 1971, fig. 57). Sometimes the pseudoparaphyllia have single-celled, large teeth, and they are mixed with filamentous pseudoparaphyllia, neither of which *Taxiphyllum* possesses. In addition, the leaf cells often have prorulae on the abaxial surface at both ends, and, most importantly, the basal row of cells at the leaf insertion is strongly prorulose at the proximal ends. The branch primordia are not evident among the pseudoparaphyllia in *Dacryophyllum* as they are in most species of *Taxiphyllum* where the raised branch primordia on the stem are surrounded by the pseudoparaphyllia. At first the pseudoparaphyllia appeared to be paraphyllia but they always or nearly always occur in clusters in the leaf axils like pseudoparaphyllia, and they are not scattered along the stems like paraphyllia. They are, however, present on the stems around the young developing branches and on the bases of more mature branches like typical pseudoparaphyllia. The lack of obvious, raised branch primordia sometimes occurs on the stems in other genera that have pseudoparaphyllia, e.g., *Isopterygium*, which has filamentous pseudoparaphyllia. Often, in *Isopterygium* species, however, there is some evidence that a branch primordium may sometime develop because of a difference in coloration, often an orange area, among the pseudoparaphyllia, or else some differentiated stem cells may be evidence that a branch primordium is present at that particular site. This type of evidence of a branch primordium was difficult to observe on the stems among the pseudoparaphyllia of *Dacryophyllum* because the clustered pseudoparaphyllia often obscured the view of the stem cells, which made it difficult to note any evidence of differentiated cells among them. Another explanation could be that they are not yet fully developed in the specimens examined, perhaps due to the absence of the necessary environmental factors at the time when the plants were collected. Sometimes some of the pseudoparaphyllia looked like paraphyllia when only one was seen at a particular site on the stem. However, none were observed on the abaxial or adaxial surfaces of the stems like paraphyllia in species that possess them, e.g., *Cratoneuron* and *Thuidium* species, where they occur randomly all around the stems. I therefore believe all of them are pseudoparaphyllia.

Dacryophyllum probably occurs elsewhere in California, and it should be searched for in calcareous habitats throughout the state. If sporophytes can be found they would undoubtedly reveal additional important information about the new genus and species. Also, it will be very interesting to see if the plants always occur in the Redwood forests of California.

Paratypes. U.S.A. **California:** Monterey Co., near S fork of Little Sur River below Old Coast Road, El Sur Ranch, 28 June 2003, *K. M. Kellman 3037* (CAS, DUKE, MO, NY, UC, US); Santa Cruz Co., Coast Redwood forest where Cave Gulch crosses under Empire Grade, on campus of U. of California, 8 Feb. 2003, *K. M. Kellman & J. Shevock 2671* (CAS, DUKE, US); cliff on opposite side of South Fork Fall Creek from Blue Cliff, above Lime Kilns, Fall Creek Division, Henry Cowell Redwoods State Park, near Felton, 15 June 2003, *K. M. Kellman 2995* (topotypes, CAS, DUKE, MO, NY, UC, US).

Acknowledgments. I am especially grateful to Kenneth M. Kellman of Ben Lomond, California, who first collected and sent me the new moss for identification, also providing me with important ecological data and a list of associated plants. I thank H. E. Robinson, Smithsonian Institution, for his support, comments on the morphology and relationship of the new taxon, as well as for his suggestion of the genus name and the preparation of the Latin description. I appreciate the interest and observations by W. R. Buck, New York Botanical Garden, on the morphology of several features of

the new species, especially his photographs of the prorulae on the basal cells that assisted the artist. I am indebted to A. J. Shaw, Duke University, for conducting the DNA test on the plants and for his comments. I am grateful to L. E. Anderson, Duke University, for rendering his opinion on the morphology and taxonomic status of the new species. D. H. Norris, University of California, brought my attention to important morphological information, which I gratefully acknowledge. P. M. Eckel, Missouri Botanical Garden, did the illustrations, and I owe her a debt of gratitude for the time taken to produce her excellent drawings. I thank S. He and V. C. Hollowell, Missouri Botanical Garden, for their helpful review of the paper, and I also have benefited from the discussion of the morphology of the new taxon by the former. Finally, the invaluable assistance of Scott Whittaker, who took pictures of the leaves of the plants with the SEM to better observe the location of the prorulae, is greatly appreciated.

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Pseudotaxiphyllum obtusifolium, a New Species of Hypnaceae (Musci) from China

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ABSTRACT. A new species, *Pseudotaxiphyllum obtusifolium* Z. Iwatsuki & B. C. Tan (Hypnaceae, Musci), is described. This moss species is related to *P. pohliaecarpum* (Sullivant & Lesquereux) Z. Iwatsuki, which is widely distributed in East Asia. The two most remarkable characters distinguishing this new species from *P. pohliaecarpum* are the shape of leaf apices, which in the former are widely obtuse to round, and also the larger laminal cells in the new species.

Key words: China, East Asia, Hypnaceae, moss, *Pseudotaxiphyllum*.

Isopterygium Mitten and related genera in Hypnaceae are one of the difficult groups of mosses and need critical revision, because there are so many species that have been little studied or inadequately examined. The senior author has been investigating this group of mosses for decades (Iwatsuki, 1970, 1987; Iwatsuki & Crosby, 1979).

Years ago, when the senior author studied the many specimens left by the late Prof. A. Noguchi, he found an interesting specimen of *Pseudotaxiphyllum* Z. Iwatsuki sent by M.-J. Lai from Taiwan. Recently, the junior author found the same species in a collection made by Ji Meng-Cheng from Jiangxi Province, China. We studied both specimens and concluded that they are the same taxon and represent a new species of *Pseudotaxiphyllum* based on the revised generic concept proposed by Iwatsuki (1987). The detailed description of the new species is as follows.

Pseudotaxiphyllum obtusifolium Z. Iwatsuki & B. C. Tan, sp. nov. TYPE: Taiwan. Ilan Co., Chi-Tuang, ca. 1000 m, on damp cliff at roadside, 27 Apr. 1983, *Ming-Jou Lai, s.n.* (holotype, NICH 50601). Figures 1, 2.

Planta robusta; caulis elongatus, ad 12 cm longus, pauce ramosus; pseudoparaphyllia nulla; cellulae corticales in sectione tranversali parvae, parietibus crassis; folia ovata, 2.0–2.5 mm longa, apice late obtusa vel rotunda; cellulae lineares, 65–110 μm longae, 7–10 μm latae.

Plants light green, often tinged with red to brown, somewhat glossy. Stems 4–12 cm or longer, 0.3–0.4 mm thick at median part, 3–4 mm wide with fresh leaves, loosely foliated, creeping, irregularly branched, in cross section showing small, thick-walled, outer cortical cells; central strand not differentiated; pseudoparaphyllia lacking; brown rhizoids on stems and branches borne below the leaf insertion. Leaves loosely foliated, widely spreading, ovate, 2.0–2.5 × 0.85–1.10 mm wide, distinctly concave; apex widely obtuse to round; margins almost entire throughout; costa thin, usually double, often reaching the middle of leaf; median laminal cells linear, with acute ends, 65–110 × 7–10 μm, ± flexuose, slightly to moderately thick-walled; cells near leaf apices much shorter; extreme basal cells rectangular or sublinear, with ± thicker walls; alar cells not differentiated. Branch leaves similar to stem leaves but smaller. Bulbils few, clustered in leaf axils, elongate, thread-like, 0.6–0.75 mm long, 30–40 μm thick, composed of spirally twisted cells, with 2 or 3 small projections at the tips. No sexual organs observed.

Paratype. CHINA. **Jiangxi Prov.:** Mt. Matou, on wet rock, *Ji Meng-Cheng 13794* (NICH 50602, SINU).

DISCUSSION

The genus *Pseudotaxiphyllum* was proposed by Iwatsuki (1987) based on several important characters distinguishable from *Isopterygium* Mitten, which was lectotypified by Iwatsuki and Crosby (1979). One of the most important characters distinguishing *Pseudotaxiphyllum* from *Isopterygium* is the lack of pseudoparaphyllia around the branch primordia. Species of *Isopterygium* have filamen-

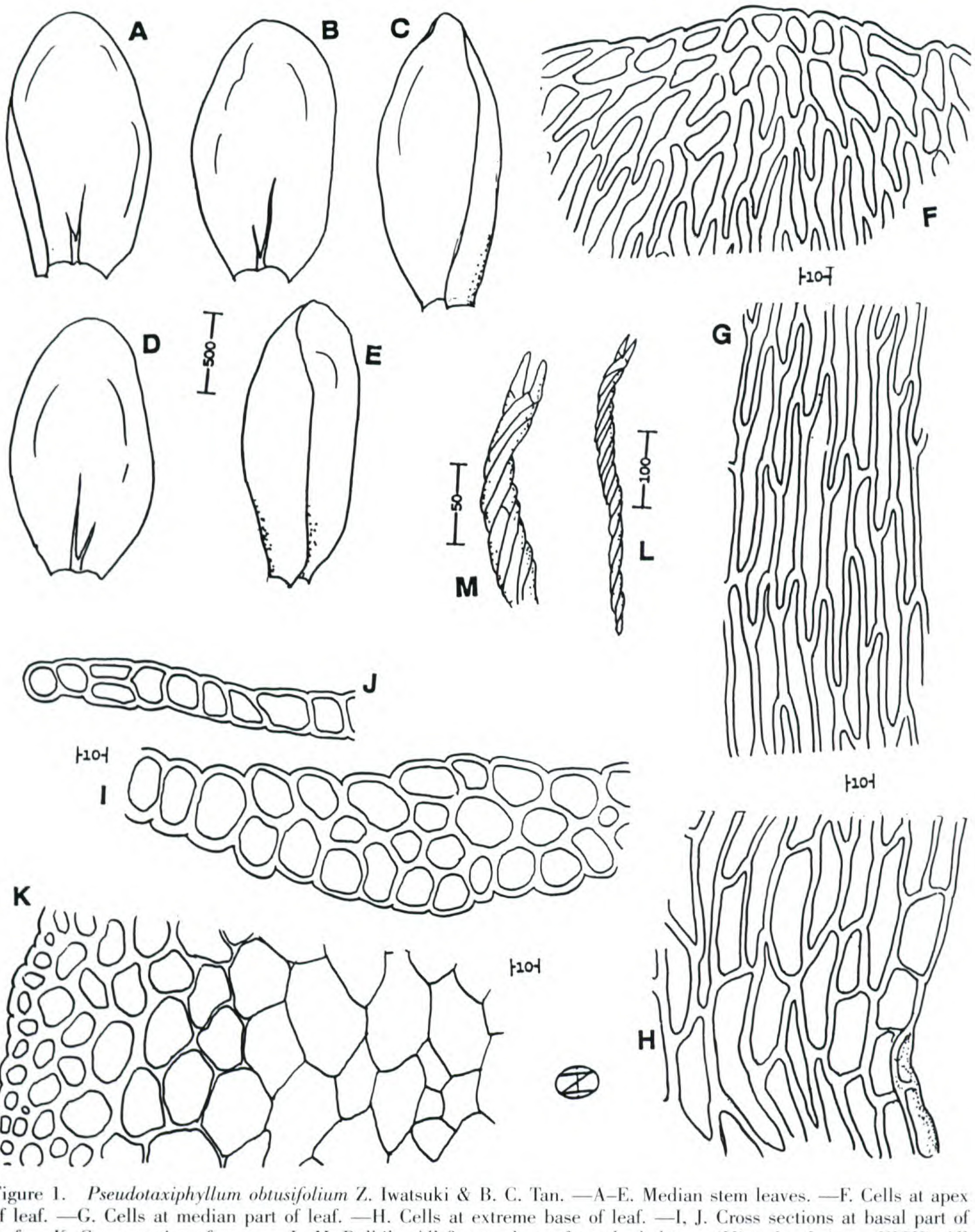

Figure 1. *Pseudotaxiphyllum obtusifolium* Z. Iwatsuki & B. C. Tan. —A–E. Median stem leaves. —F. Cells at apex of leaf. —G. Cells at median part of leaf. —H. Cells at extreme base of leaf. —I, J. Cross sections at basal part of leaf. —K. Cross section of stem. —L, M. Bulbils. All figures drawn from the holotype (*Ming-Jou Lai s.n.*, NICH). All scales in μm.

tous pseudoparaphyllia, while another closely related genus, *Taxiphyllum* Fleischer, has foliose pseudoparaphyllia. Details of bulbils found in *Pseudotaxiphyllum* were shown by Iwatsuki and Deguchi (1981).

The new species, *Pseudotaxiphyllum obtusifolium*, has bulbils in leaf axils similar to those of *P. pohliaecarpum*, a common species in East Asia. As shown in Figure 2F, *P. obtusifolium* has no pseudoparaphyllia on stems and branches. The two most remarkable characters distinguishing this new species from *P. pohliaecarpum* are the shape of leaf

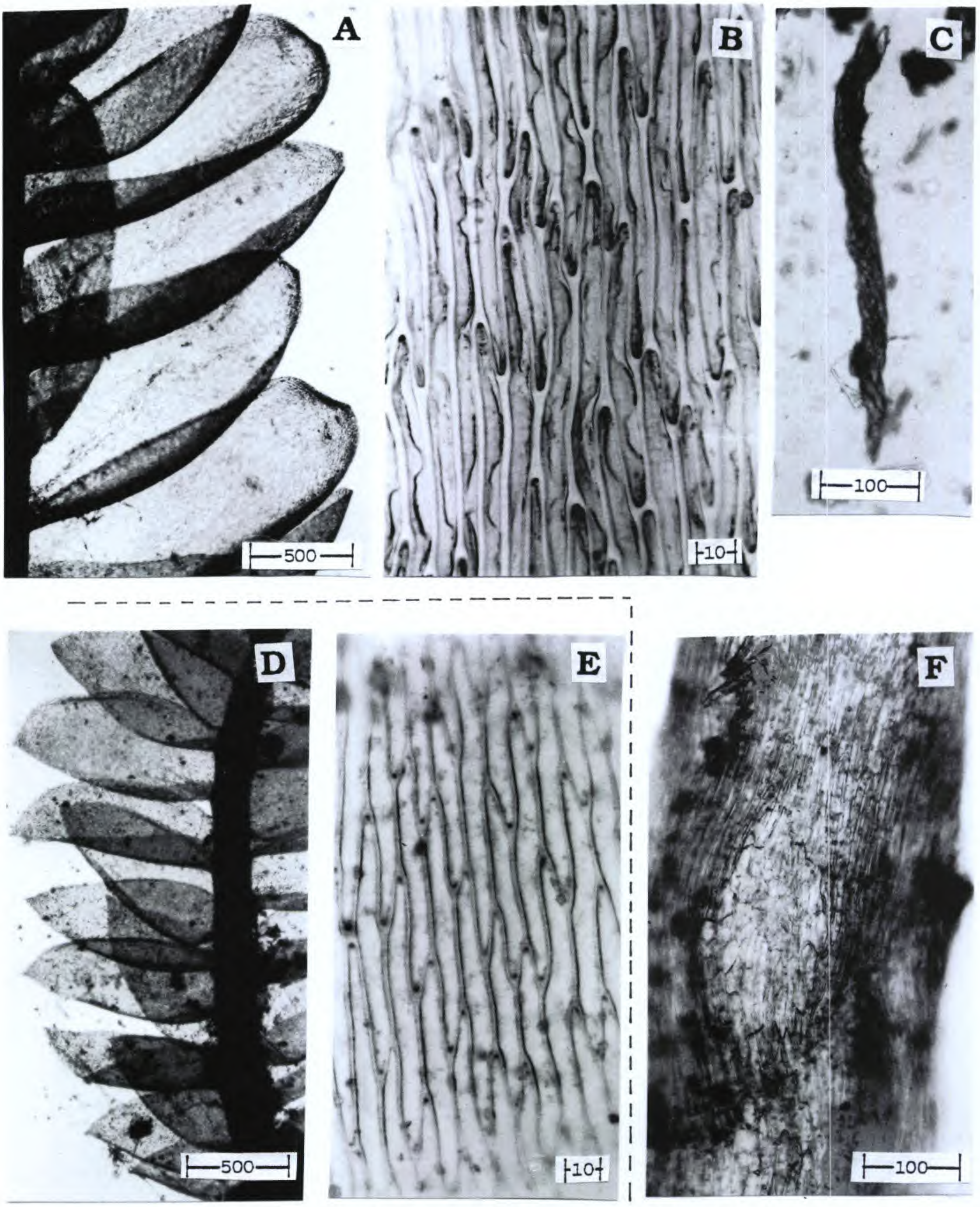

Figure 2. *Pseudotaxiphyllum obtusifolium* (A–C, F) and *P. pohliaecarpum* (D, E). —A, D. Parts of stems with leaves. —B, E. Cells at median part of leaves. —C. Bulbil. —F. Branch primordium without pseudoparaphyllia. A–C, and F, based on the holotype of *P. obtsusifolium*. D, E, based on Musci Japonici Exsiccati no. 528 (issued as *Isopterygium pohliaecarpum*). Both specimens at NICH. All scales in μm.

apices, which in the former are widely obtuse to round, and also the larger laminal cells in the new species (Figs. 1G, 2B). The distinctions between these two taxa are summarized in Table 1.

At present, we know of only two specimens of this new species collected from Taiwan and Jiangxi Province of China, respectively. Both specimens were collected on wet or damp rocks. It may be

Table 1. Diagnostic characters of *Pseudotaxiphyllum obtusifolium* and *P. pohliaecarpum*.

Characters	*P. obtusifolium*	*P. pohliaecarpum*
Size of median leaves (mm)	2.0–2.5 × 0.85–1.1	1.0–1.5 × 0.45–0.50
Leaf apices	widely obtuse to round	acute to widely acute
Size of median laminal cells (μm)	65–110 × 7–10	80–100 × 4–6
Walls of median laminal cells	slightly to moderately thick-walled (Fig. 2B)	thin-walled (Fig. 2E)

expected that this new species will be found in similar habitats elsewhere in eastern Asia.

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Passiflora inca, a New Species of Passifloraceae from Peru and Bolivia

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ABSTRACT. *Passiflora inca*, a new species from Peru and Bolivia, from the Vilcabamba–Amborró corridor, is described. An illustration, photographs of the flower, and SEM photos of the indument and leaf details are presented. The new species differs from the other species of the *Passiflora lobbii* group in usually multiflowered inflorescences and diffuse laminar nectaries (only known from *P. lobbii* subsp. *ayacuchoensis* within the species group).

RESUMEN. Se describe *Passiflora inca* una especie nueva del corredor Vilcabamba–Amborró de Perú y Bolivia. Se presenta una ilustración y fotografías de la flor y fotos de microscopio electrónico de barrido del indumento y de detalles de las hojas. La especie nueva difiere de las demás especies del grupo *Passiflora lobbii* en tener inflorescencias multifloras y nectarios laminares difusos (solamente conocidos en *P. lobbii* subsp. *ayacuchoensis* en el grupo).

Key words: Andes, Bolivia, endemic, *Passiflora*, Passifloraceae, Peru, Vilcabamba–Amborró corridor.

The genus *Passiflora* L. contains about 500 species in the New World. The largest concentration of species is found in the Andes, and many species are endemic to "hotspots" (regions that contain great diversity of endemic species and are significantly impacted by human activities) in the Tropical Andes. The species we describe here grows exclusively within the so-called Vilcabamba–Amborró corridor "hotspot." Six collections from southern Peru and the Bolivian Andes revealed this new species belonging to the *Passiflora lobbii* Masters group in subgenus *Decaloba* DC. (Skrabal et al., 2001). The *Passiflora lobbii* group is found from southern Ecuador to northern Bolivia and consists of nine species. Six species (viz. *P. callacallensis* Skrabal & Weigend, *P. podlechii* Skrabal & Weigend, *P. sanchezii* Skrabal & Weigend, *P. sagastegui* Skrabal & Weigend, *P. solomonii* L. K. Escobar, and *P. tesserula* Skrabal & Weigend) can be characterized as narrowly endemic species (Skrabal et al., 2001). The remaining three species have a broader distribution: *P. exoperculata* Masters, disjunct in southern Ecuador and northern Bolivia (Holm-Nielsen et al., 1988; Skrabal et al., 2001); *P. lobbii*, with its three subspecies in central Peru (Skrabal et al., 2001); and the species described here from southern Peru and neighboring Bolivia.

Passiflora inca P. Jørgensen, sp. nov. TYPE: Peru. Cusco: La Convención, road from Cusco to Quillabamba, after pass Abra Malaga and before Ipal, 2600–2700 m, 13°4′S, 72°22′W, 24 Feb. 2000, *M. & K. Weigend 2000/426* (holotype, USM; isotypes, HUT, MO, MSB, NY). Figures 1, 2.

A *Passiflora exoperculata* inflorescentiis multifloris, paginis abaxialibus foliorum pubescentibus, foliis glandulis duabus vel pluribus inter costam et nervos laterales praeditis recedit.

Vine, pubescent throughout except for certain floral parts and the glabrescent adaxial lamina surface, trichomes simple, straight and translucent, white or slightly yellow; stem cylindrical or angled when young, becoming angled and grooved with age and gradually losing some of its pubescence; internodes 1.6–5.6 cm long. Stipules 4.5–6 mm long, aristate, early deciduous; axillary buds covered by two prophylls; petiole 0.6–1.8 cm long, caniculate, 2 auricular glands at the middle (Bolivia) or at apex (Peru); lamina 2.1–6.3 × 3.9–7.2 cm, intermediate between transverse obtriangular and transverse rectangular in outline, coriaceous, base truncate to cordate, slightly lustrous above, in mature leaves pubescence present above only along primary nerves (diminishing toward the margin) and hispi-

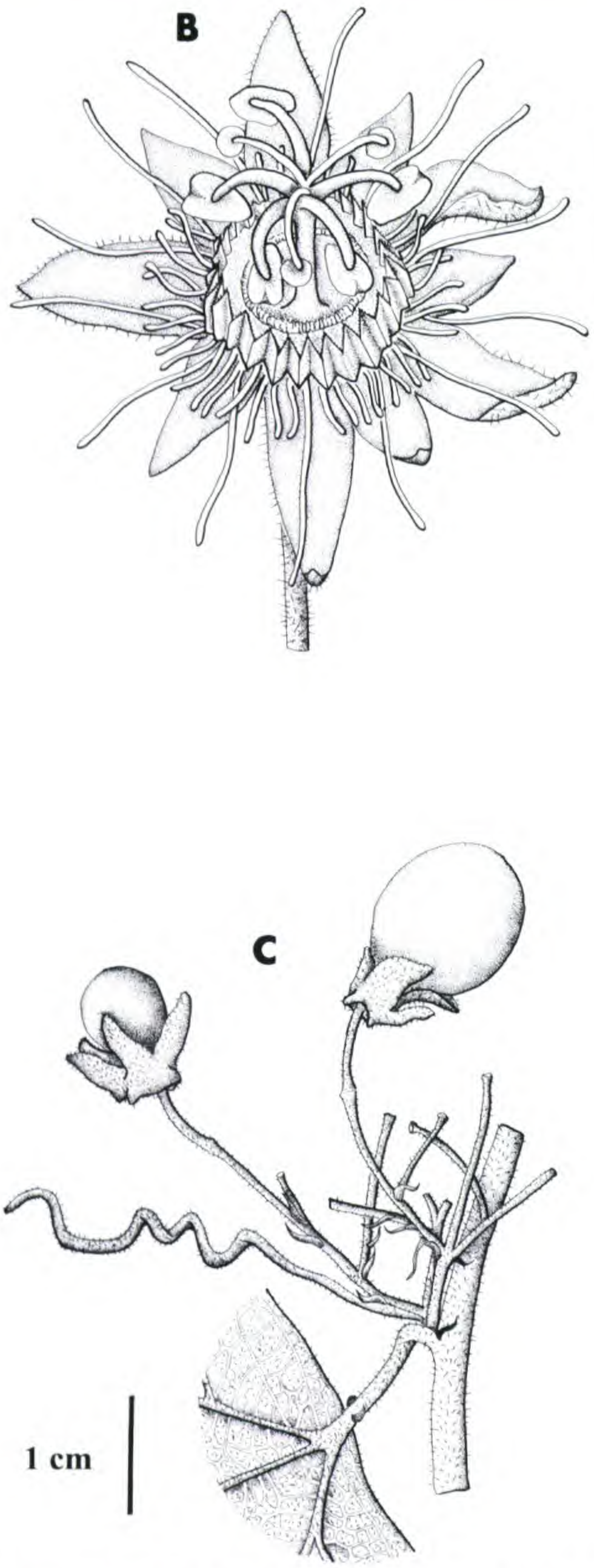

Figure 1. *Passiflora inca* P. Jørgensen —A. Habit. —B. Flower. —C. Infructescence and fruit. (*M. & K. Weigend 2000/426*, MO isotype.)

dulous along the margin, dull below, margin entire and slightly revolute, trinerved, branching occurs a few mm from the leaf base, each primary nerve ending in a distinct mucro, venation outside the lateral nerves brochidodromous, between primary nerves camptodromous and reticulate, the veins slightly raised above and strongly raised below, where they intersect often flattened and covering small sections of the lamina, lateral nerves divaricate to oblique at an angle of 72°–97°, 2 to 5 small glands formed on secondary or tertiary veins between midvein and lateral nerves. Flowers light green to green with a dark purple corona or black central ring, in two 1- to 6-flowered cymes per axil; bracts 1.3–1.9 × 0.2–0.3 mm, aristate, occasionally split subapically in two or three; peduncles (to first branch) 7–11 mm; floral stipe 4–6 mm (Bolivia) or 7–11 mm (Peru); hypanthium (5–)6–7 mm diam., patelliform, pentagonal with small spurs in the corners of the sepals; sepals 5.7–6.2 × 1.8–2.0

Figure 2. Photographic plate of *Passiflora inca*. —A. Leaf, abaxial surface, with darker areas around the laminar nectaries. —B. Immature and mature fruit. —C. Flower, frontal view. —D. Flower, lateral view. —E. Adaxial surface of young leaf with sparse cover of simple trichomes (SEM). —F. Abaxial leaf surface of young leaf with dense cover of simple trichomes (SEM). —G. Mucronate leaf tip, abaxial surface of young leaf (SEM). —H. Indistinct nectary on abaxial leaf surface. Note the slightly dome-shaped nectary at the junction of the leaf veins; in the living plant the nectaries are dark brown and thus clearly set off from the pale green abaxial surface (SEM). (*M. & K. Weigend 2000/426.*)

mm, narrowly oblong to narrowly ovate, abaxial central part pubescent, margin broadly hyaline and glabrous, not awned; petals 3.8–4.2 × 1.4–1.6 mm, narrowly ovate, hyaline, glabrous; outer coronal series 4.5–5.2 mm, with few members, filiform or filiform with a clavate apex; inner corona series 1.5–2 mm, more numerous, filiform with a clavate and papillate apex, occasionally up to 4 filaments irregularly fused; operculum 1.6–1.7 mm high, plicate with ciliate margin; limen present; androgynophore 2.3–2.6 mm; staminal filaments fused for yet another 2 mm until the top of the ovary and surrounding the ovary, free part of filaments 2.5–2.7 mm, linear; thecae 2.1 × 1–1.3 mm; ovary 1.9 × 1.1 mm, obovoid, glabrous; styles 2.6 mm, filiform; stigma 0.75–1.2 mm diam., capitate. Fruit 10–14.5 × 9–10.3 mm, subspherical, dark blue with light waxy bloom; seeds asymmetric, chalazal beak inclined toward the raphe, irregularly pitted near base, pits arranged in rows toward the micropyle, ca. 45 pits.

Etymology. The species is named after the Inca culture, which still is prevalent at the type locality, the Urubamba valley, and had its cultural center, Machupichu, close to the type locality.

Distribution and habitat. *Passiflora inca* is a cloud forest species and has been found twice in the Urubamba valley, the northern part of the Vilcabamba ridge, in Peru; once in the Chimu Valley in the Cordillera de Quinza Cruz, and three times in the valley of río Espiritosanto between the Cordilleras Cochabamba and Tiraque in Bolivia. It is one of the four eastern slope taxa of the *Passiflora lobbii* group (together with *P. callacallensis*, *P. lobbii* subsp. *ayacuchoensis* Skrabal & Weigend, and *P. exoperculata*); the other taxa are from at least seasonally dry habitats. Minimum and maximum elevation for all labels are 2300 and 4150 m respectively, but we believe that a range of 2500–2900 m is more realistic. *Passiflora inca* is extremely abundant in the secondary vegetation at the type locality and forms hanging curtains over the road cutting.

Phenology. The species has been collected from February 4 to July 25 in bud, flowers, and with young to almost mature fruits. There were numerous mature fruits on the plants at the type locality.

Diagnostic characters and possible relationships. Three of the paratypes cited below (*Besse et al. 1859*, *Lewis 38638*, and *Beck 4008*) were included in the citations of specimens for *P. exoperculata* in Skrabal et al. (2001). They probably contributed significantly to the broadening of the *P. exoperculata* concept and are potentially the specimens that triggered comments like "abaxial lamina . . . pilose only in . . . some Bolivian specimens" and "the southern populations are morphologically more variable in leaf shape, pilosity, and number of flowers per axil." Not only do these quotations show that there is morphological similarity between *P. inca* and *P. exoperculata*, they also serve to list some of the characters that distinguish the two species. *Passiflora inca* keys out to *P. exoperculata* in Skrabal et al. (2001) but is distinguishable by a multiflowered inflorescence, pubescence on the lamina surface, and the laminar glands. This last character can be particularly emphasized as it is observed only in *P. lobbii* subsp. *ayacuchoensis* within the *P. lobbii* group.

The most striking feature of *Passiflora inca* is, however, its multiflowered inflorescences, which clearly distinguish it from all other members of the group. Occasionally it is reduced to a single flower as it is seen in most axils on *Besse et al. 1859*, *Kessler & Kelschebach 245*, and *Beck 4008*; the last collection is the only collection where we have not found a single branched inflorescence. A similar pattern is known from the only distantly related *P. sexflora* Jussieu, where some populations in Central America and Ecuador have inflorescences reduced to a single flower. Potentially this new species could mark a connection between the *P. lobbii* group and the species surrounding *P. sodiroi* Harms (including *P. monadelpha* P. Jørgensen & Holm-Nielsen and *P. ursina* Killip & Cuatrecasas). Characters of that group that may be homologous and indicate relationship are the multiflowered inflorescences; a raised reticulate venation pattern found in *P. sodiroi*; the subtle formation of spurs and similar laminar nectaries found in *P. monadelpha*, and *P. ursina*, and more prominently developed in *P. sodiroi*; and the wilted flowers that persist below the fruit until it matures in all the mentioned species. The two last characteristics, wilted flower persisting below the developing fruit and the formation of small spurs in the corners between the sepals, are found also in several taxa in the *P. lobbii* group to varying degree. We have observed spurs in *P. lobbii*, *P. podlechii*, *P. callacallensis*, *P. sanchezii*, *P. sagasteguii*, *P. exoperculata*, and *P. inca*. The only species where this characteristic seems to be completely absent is in *P. tesserula*. We have seen fruits with remains of the wilted flower in *P. lobbii*, *P. sagasteguii*, *P. exoperculata*, and *P. inca*. The fused filaments, beyond the base of the ovary, is also a very unusual character found also in *P. monadelpha*.

Paratypes. PERU. **Cusco:** Urubamba, a 88 y 112 km de Cusco, Santuario Histórico de Machupichu y el Camino Inca, 13°9′S, 72°31′W, 2300–4150 m, *P. Nuñez & F. Luna 8874* (CUZ, MO). BOLIVIA. **La Paz:** Province of Inquisivi, Valle de Chimu, on the slopes W of Pavionani fork of the río Chimu, 1–3 km NW of Estancia Chimu, 7 km NE of Choquetanga, 16°48′S, 67°16′W, 2900–3200 m, 14 Apr. 1991, *M. Lewis 38638* (LPB, MO). **Cochabamba:** Province of Chapare, km 72 Cochabamba–Villa Tunari, 2500 m, 4 Feb. 1983, *L. Besse et al. 1859* (MO); Province of Chapare, road to Chapare, turnoff towards Vinto, Hydroelectric plant Corani, 1 km from main road, 2500 m, 5 June 1980, *S. G. Beck 4008* (LPB, MO); Province of Chapare, Hydroelectric plant Corani, 61.4 km from Cochabamba towards Chapare, 2750 m, *M. Kessler & M. Kelschebach 245* (GOET, LPB).

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Five New Species of the Endemic Hawaiian Genus *Cyanea* (Campanulaceae: Lobelioideae)

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Abstract. Five new species of *Cyanea* (Campanulaceae: Lobelioideae) are described from the Hawaiian Islands, U.S.A. The first, *C. magnicalyx* Lammers (West Maui), is a member of the *C. grimesiana* complex, related to *C. cylindrocalyx* (Rock) Lammers. *Cyanea duvalliorum* Lammers & H. Oppenheimer and *C. maritae* Lammers & H. Oppenheimer (East Maui) resemble *C. magnicalyx* in their parted or divided adult leaves and might seem to belong likewise to the *C. grimesiana* complex; however, other characters suggest these two novelties are actually related to *C. scabra* Hillebrand and *C. mceldowneyi* Rock in the *C. scabra* complex. *Cyanea minutiflora* Lammers and *C. pseudofauriei* Lammers (Kaua'i) are newly segregated from *C. fauriei* H. Léveillé, which is here lectotypified and treated as a synonym of *C. coriacea* (A. Gray) Hillebrand; the former novelty has the smallest flowers in the genus.

Key words: Campanulaceae, *Cyanea*, Hawaiian Islands, Lobelioideae.

Cyanea Gaudichaud (including *Rollandia* Gaudichaud) is a genus of woody Lobelioideae (Campanulaceae) endemic to montane wet or mesic forests of the Hawaiian Islands. It is distinguished from the related genera *Clermontia* Gaudichaud and *Delissea* Gaudichaud by its combination of unbranched or sparingly branched habit, 4- to 45-flowered racemose inflorescences, chartaceous or coriaceous leaves, typically bracteolate pedicels, corollas that are dorsally cleft to about the middle, relatively small thin-walled berries, and smooth or minutely papillose dark seeds (Lammers, 1990a, 1991; Buss et al., 2001). The genus has been divided into three (Hillebrand, 1888; Wimmer, 1943; St. John, 1969) or five (Rock, 1919) sections, but neither classification is congruent with a recent molecular phylogeny (Givnish et al., 1994, 1995).

The most recent taxonomic treatment of *Cyanea* is the account contributed (Lammers, 1990a) to the *Manual of the Flowering Plants of Hawai'i*, in which 52 species were recognized. Since that time, the genus has been enlarged by its merger with *Rollandia*, the resurrection of species synonymized in or omitted from the *Manual*, and the description of new species (Lammers, 1992, 1996, 1998a, 1999; Lammers & Lorence, 1993; Lammers et al., 1993). In this paper, five more species are described as new, bringing the total number of species in *Cyanea* to 77.

A note on measurements is warranted. Several specimens examined and cited here consist of both standard herbarium sheets and jars of liquid-preserved material; these are labeled in accordance with Article 8.3 of the *International Code of Botanical Nomenclature* (ICBN; Greuter et al., 2000). However, all measurements reported herein were derived solely from dried material, for the sake of consistency with earlier studies based solely on standard herbarium specimens.

Another Segregate of *Cyanea grimesiana*

In my previous account of *Cyanea* (Lammers, 1990a), *C. grimesiana* Gaudichaud subsp. *grimesiana* was construed quite broadly, encompassing all populations of the species on Moloka'i, Lāna'i, and Maui, as well as those in the Ko'olau and northern Wai'anae Mountains of O'ahu. In a subsequent revision of *C. grimesiana* (Lammers, 1998a), plants of subspecies *grimesiana* from Lāna'i and most of those from Moloka'i were segregated as *C. munroi* (Hosaka) Lammers, while those from Maui were segregated as *C. mauiensis* (Rock) Lammers. At the same time, *C. grimesiana* subsp. *cylindrocalyx* (Rock) Lammers of Hawai'i was elevated to species rank as *C. cylindrocalyx* (Rock) Lammers, while *C. grimesiana* subsp. *obatae* (H. St. John) Lammers of the southern Wai'anae Mountains of O'ahu was maintained.

Since that revision, a few specimens from West Maui have been examined, which are referable to the *C. grimesiana* complex but lack the distinctive features of *C. mauiensis*: campanulate hypanthium rounded or truncate at base, corolla 7.5–12 times longer than the hypanthium with lobes as long as the tube or longer, and dorsal anthers 15–16 mm long. Instead, these plants resemble *C. cylindro-*

calyx, *C. grimesiana*, and *C. munroi* in their obconic hypanthium attenuate at base, shorter corolla (only 6.5 times longer than the hypanthium) with dorsal lobes shorter than the tube, and shorter anthers (9.5–12 mm long). However, the West Maui plants cannot be referred to any of these three species (none of which occur on Maui) as they differ in diverse ways. From *C. grimesiana* (O'ahu and Moloka'i), they differ in having the upper portion of the lamina less deeply cut (cleft or parted vs. divided), the calyx lobes longer (36–44 vs. 3–30 mm), and the dorsal corolla lobes nearly as long as the tube (vs. ⅓–⅔ as long). From *C. munroi* (Moloka'i and Lāna'i), they differ in having the calyx lobes erect from base (vs. spreading at base before curving upward), the laterally compressed corolla tube tallest at base (vs. at or near middle), and the surfaces of the anther tube glabrous (vs. pubescent at base).

Of these species, *C. cylindrocalyx* of the Waipi'o Valley of Hawai'i seems most similar to the plants of West Maui. In both, the upper portion of the lamina is pinnately parted or cleft and 2–4.5 cm wide between the segments (vs. pinnately divided and 0.2–3.2 cm wide between the segments in the other species), and the dorsal corolla lobes are ¾ as long as the tube to almost as long (vs. ⅓–⅔ as long). However, the West Maui plants differ from *C. cylindrocalyx* in their pinnae separated by sinuses (vs. overlapping), longer hypanthium (10–15 vs. 8–10 mm), distinct overlapping calyx lobes 36–44 mm long (vs. basally connate and 20–27 mm), and anther tube with all five anthers apically tufted (vs. the ventral two only). The West Maui plants are distinct from all other elements of the *C. grimesiana* complex, and are here accorded specific rank.

Cyanea magnicalyx Lammers, sp. nov. TYPE: U.S.A. Hawaiian Islands: West Maui, Honokōhau drainage basin, 25 Sep.–17 Oct. 1917, *C. N. Forbes 434.M* (holotype, BISH; isotype, NY). Figure 1.

Species ex affinitate *Cyaneae grimesianae*, sed a *C. grimesiana* lamina versus apicem partita vel fissa, calycis lobis 36–44 mm longis, et corollae lobis dorsalibus longitudine tubum fere aequantibus; a *C. cylindrocalyx* laminae pinnis nonsuperpositis, pedicellis 33–36 mm longis, hypanthio 10–15 mm longo, calycis lobis 36–44 mm longis distinctis et superpositis versus basim apice acuminatis, et omnibus antheris penicillatis ad apicem; a *C. mauiensis* hypanthio obconico basi attenuato, calycis lobis 36–44 mm longis 7–13 mm latis distinctis et superpositis versus basim, corolla glabra hypanthio 6.5 plo longiore, et antheris dorsalibus 9.5–12 mm longis; et a *C. munroi* calycis lobis rectis et erectis, corollae tubo basi latissimo, et antherarum tubo glabro distinguenda.

Shrubs, 1.5–3 m tall; stems branched from base, ca. 1.3 cm diam. Lamina elliptic, 36–55 cm long, 19–27 cm wide across the segments, 0.4–4.5 cm wide between the segments; upper surface green, glabrous; lower surface light green, glabrous; margin pinnately cleft or parted toward apex, pinnately compound toward base; segments narrowly oblong or narrowly triangular, 8–15 × 1.8–5 cm, 9 or 10 per side, separated by sinuses, the margin callose-serrate or shallowly lobed (the lobes shallowly deltate or shallowly triangular, 5–12 × 6–17 mm, acuminate and apiculate at apex); apex acuminate, apiculate; petiole 12–21 cm long, 3.5–6 mm diam., ⅓–½ as long as the lamina, glabrous, muricate. Racemes 6- to 15-flowered; peduncle ascending, 35–55 mm long, 2.2–4 mm diam., glabrous, sparsely muriculate; rachis 14–25 mm long, glabrous; bracts linear or lanceolate, 14–25 × 2.5–4 mm, subtending the pedicels, sometimes a few empty ones on the peduncle, long persistent, acuminate at apex; pedicels ascending, 33–36 mm long, 1.2–1.3 mm diam., ebracteolate, glabrous. Hypanthium obconic, 10–15 mm long, 7–9 mm diam., ⅙ as long as the corolla, glabrous, the base attenuate; calyx lobes ovate, lanceolate, or oblong, 36–44 × 7–13 mm, distinct, overlapping at base, erect from base, glabrous, the margin entire, acuminate and apiculate at apex; corolla yellowish white, longitudinally striped with purple, 65–70 mm long, glabrous; corolla tube laterally compressed, 35 mm long; dorsal corolla lobes 32 mm long; filament tube 55 mm long, 1 mm diam., glabrous; anther tube suberect, 2.8–3.2 mm diam., all 5 anthers with tufts of hairs 4–5 mm long at apex, the surfaces glabrous; dorsal anthers 9.5–12 mm long, ⅕–¼ as long as the filament tube; ventral anthers 8–9 mm long. Mature fruit and seeds not seen.

Additional illustration. Lammers (1990a), pl. 53, upper right (lower inset) [as *C. grimesiana* subsp. *grimesiana*].

Distribution, habitat, and phenology. Endemic to West Maui in the Hawaiian Islands, in mesic forest at ca. 450 m elevation. Flowering during September and October. Both this species and its relative *C. mauiensis* have been collected in Olowalu Valley, the former by C. N. Forbes (see below), the latter by W. Hillebrand (cf. Lammers, 1994, 1998a).

The currently recognized taxa that comprised *C. grimesiana* as formerly circumscribed (Hillebrand, 1888; Rock, 1919; Wimmer, 1943; Lammers, 1990a) may be distinguished using the following key. It may be inserted into the most recent key to

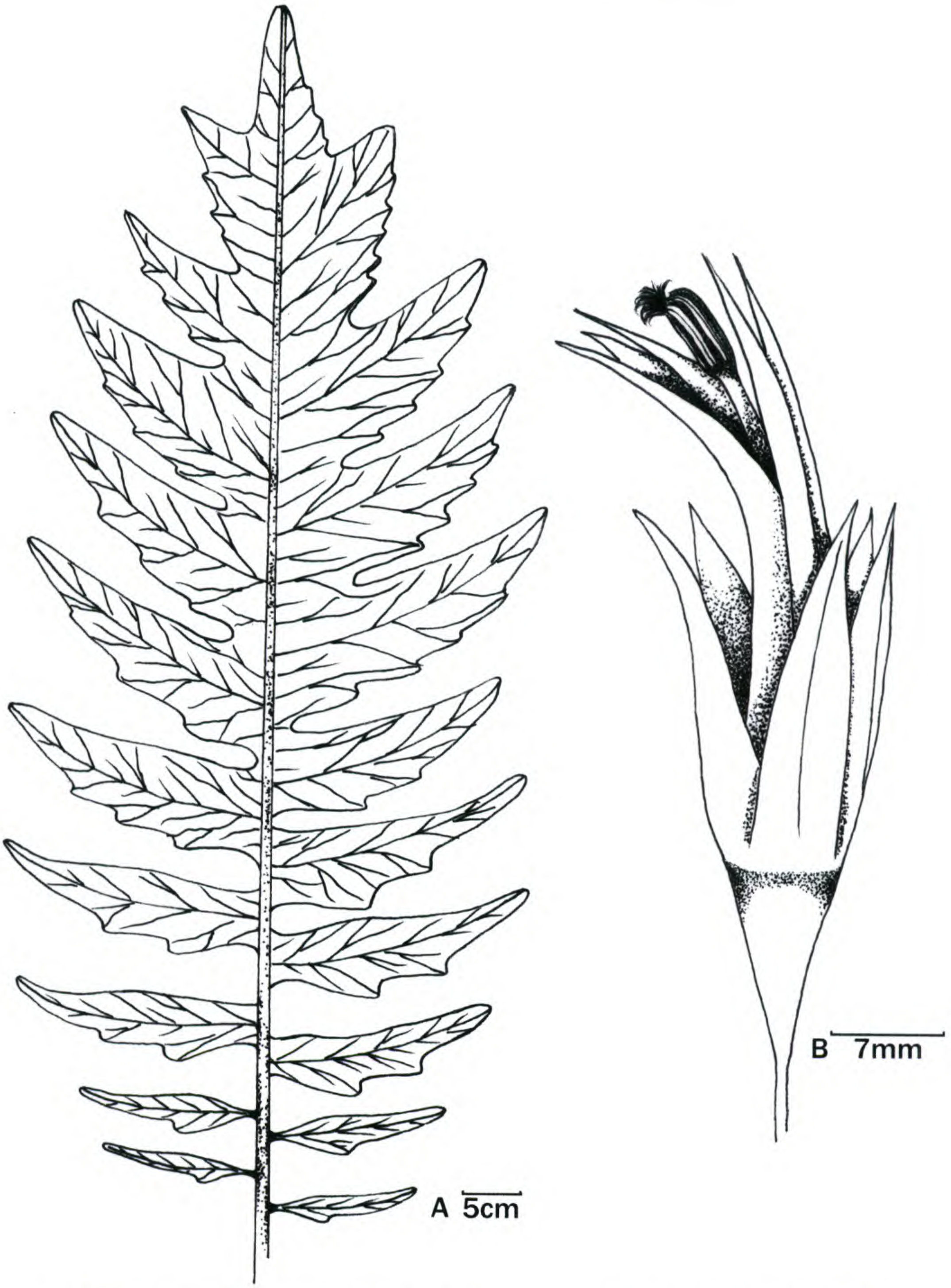

Figure 1. *Cyanea magnicalyx* Lammers. —A. Leaf. —B. Flower. (Drawn from the holotype, *Forbes 434.M.*)

the genus (Lammers, 1990a) following the first statement in couplet 47 on p. 443.

KEY TO THE SPECIES OF THE HAWAIIAN *CYANEA GRIMESIANA* COMPLEX

1a. Hypanthium campanulate, the base rounded or truncate; corolla 7.5–12 times longer than hypanthium, the dorsal lobes 35–40 mm long, as long as the tube to half again as long; dorsal anthers 15–16 mm long, ventral 12–14 mm long (West and East Maui) . . . . . *C. mauiensis*

1b. Hypanthium obconic, the base attenuate; corolla

4–7.5 times longer than hypanthium, the dorsal lobes 15–32 mm long, ⅓ as long as the tube to about as long; dorsal anthers 9.5–14 mm long, ventral 7.5–10 mm long.

2a. Calyx lobes spreading at base before curving upward; corolla tube tallest at or near middle, tapering toward both apex and base, strongly arcuate; base of anther tube pubescent (Moloka'i, Lāna'i) . . . . . *C. munroi*

2b. Calyx lobes erect from base or nearly so; corolla tube tallest at base, tapering toward the apex, curved or somewhat arcuate; base of anther tube glabrous.

3a. Upper portion of lamina pinnately divided, 0.2–1.5 cm wide between the segments; dorsal corolla lobes ⅓–⅔ as long as the tube.

4a. Segments of the lamina narrowly elliptic, narrowly oblong, or narrowly triangular; calyx lobes linear or narrowly triangular, 3–13 × 1–2 mm, separated at base by narrow sinuses; anther tube 2.5–3.2 mm diam. (S Wai'anae Mts. of O'ahu) . . . . . *C. grimesiana* subsp. *obatae*

4b. Segments of the lamina lanceolate or rarely narrowly elliptic; calyx lobes ovate or lanceolate, 15–30 × 4–10 mm, overlapping at base; anther tube 3.5–4.5 mm diam. (Ko'olau and N Wai'anae Mts. of O'ahu, Moloka'i) . . . . . *C. grimesiana* subsp. *grimesiana*

3b. Upper portion of lamina pinnately parted or cleft, 2–4.5 cm wide between the segments; dorsal corolla lobes ¾ as long as the tube to almost as long.

5a. Adjacent segments of the lamina separated by sinuses; pedicels 33–36 mm long; hypanthium 10–15 mm long; calyx lobes 36–44 mm long, distinct but overlapping at base, the apex acuminate; all five anthers pubescent at apex (West Maui) . . . . . *C. magnicalyx*

5b. Adjacent segments of the lamina overlapping; pedicels 19–28 mm long; hypanthium 8–10 mm long; calyx lobes 20–27 mm long, connate at base for 7–25 mm, the apex acute or obtuse; only the two ventral anthers pubescent at apex (Waipi'o Valley of Hawai'i) . . . . . *C. cylindrocalyx*

Paratypes. U.S.A. Hawaiian Islands. West Maui. **Lahaina:** Honokōhau drainage basin, *Forbes 409.M* (A, BISH, P, US); central ridge of Olowalu Valley, *Forbes 2350.M* (BISH), *Forbes 2429.M* (BISH). **Wailuku:** 'Īao Valley, *Hobdy & Sylva 1711* (BISH); canyon E of 'Īao Needle, *Hobdy 2052* (BISH); gulch E of 'Īao Needle, *Lammers, Kepler & Ecton 5579* (BISH, F, OS); Waikapū Valley, *Rock 10265* (BISH); Waihe'e Valley, Sep 1918, *Rock s.n.* (BISH).

Two New Species Allied to *Cyanea scabra*

On 2 January 2000, a party of Hawaiian naturalists was enjoying a casual hike on windward East Maui. Fern Duvall, Renate Gassmann-Duvall, Hank Oppenheimer, and Marita Lewis were exploring a complex system of trails below Waikamoi Flume Road. At about 855 m above sea level, their trail came to a dead end where Wai'ohiwi Stream flowed along the base of a small steep hill. Across the stream, Gassmann-Duvall spotted several individuals of a tall arborescent *Cyanea* with dissected leaves. During subsequent visits, additional plants were discovered in the vicinity that were similar but shorter and shrubby. A third *Cyanea* with dissected foliage was also collected, approximately 100 m away from the other two. Though specimens of this last plant (e.g., *Oppenheimer & Duvall H10006*, BISH, OSH, PTBG) were readily identified as a known species, *C. aspleniifolia* (H. Mann) Hillebrand, the identity of the first two remained problematic.

Specimens of both unknowns were forwarded to me for identification. The first step was to ascertain whether the shrubs and trees represented one species or two. Developmentally related variation in vegetative morphology is not uncommon in *Cyanea* (Carlquist, 1974; Lammers, 1990a, 1990b; Givnish et al., 1994, 1995), and it was conceivable that the two gatherings represented juvenile and adult stages of a single species. The shrubs and the trees do have a number of features in common, most conspicuously their prickly stems and herbage; pinnately parted or divided adult leaves; oblong floral bracts and calyx lobes; relatively large white flowers with a stout arcuate laterally compressed corolla tube that is tallest above the middle; and orange berries crowned by the persistent calyx lobes. However, the two could be distinguished consistently by numerous features besides habit, including branching pattern, details of the leaf margin, length of the petiole, size of the bracts and floral organs, staminal pubescence, and fruit size (see key below for details). On this basis, the trees and shrubs were judged to represent two distinct species rather than developmental stages of one species. This conclusion was supported by discovery of the actual juvenile plants of both, which differed profoundly in leaf morphology from each other.

The second step was to determine if either gathering could be referred to any species included in the most recent treatment of the genus (Lammers, 1990a) or recognized subsequently (Lammers, 1992, 1996, 1998a, 1999; Lammers & Lorence, 1993; Lammers et al., 1993). Leaf dissection is an

unusual character in *Cyanea*, found in only a few species. Dissection of the adult lamina for its entire length and for more than half the distance to the midrib is found in even fewer: *C. aspleniifolia* (West and East Maui) and its ally *C. shipmanii* Rock (windward Mauna Kea on Hawai'i); *C. horrida* (Rock) O. Degener & Hosaka (East Maui); *C. pinnatifida* (Chamisso) E. Wimmer (Wai'anae Mts. of O'ahu); and *C. grimesiana* and its recent segregates *C. cylindrocalyx*, *C. magnicalyx*, *C. mauiensis*, and *C. munroi* (see above).

Of these, *C. aspleniifolia*, *C. horrida*, *C. pinnatifida*, and *C. shipmanii* certainly do not match nor even much resemble either of the Wai'ohiwi species in floral morphology. All four have corolla tubes that are terete (vs. laterally compressed), of approximately equal height throughout (vs. tallest above the middle), and (except for *C. horrida*) relatively slender and suberect or only slightly curved (vs. stouter and strongly arcuate). *Cyanea grimesiana* and its allies, on the other hand, do have stout arcuate laterally compressed corolla tubes tallest above the middle, similar to those seen in the plants from Wai'ohiwi Stream. However, none of the known members of that complex matches these two species, i.e., they could not be identified using the key above. For these reasons, the two species discovered at Wai'ohiwi Stream were judged to be undescribed. The arborescent species is here named *C. duvalliorum*, its shrubby congener *C. maritae* (see below).

The third step was to ascertain the relationships of these novelties to other members of the genus. One might assume that *C. duvalliorum* and *C. maritae* would be referable to the *C. grimesiana* complex, as these are the only other species in the genus that combine deeply dissected adult foliage with stout arcuate laterally compressed corollas. However, *C. duvalliorum* and *C. maritae* differ from *C. grimesiana* and its allies in two rather significant features. First, the two novelties produce juvenile plants that differ conspicuously from adults in leaf outline. No such dimorphism is evident in the *C. grimesiana* complex; leaves of juveniles resemble those of adults, so far as known. Second, *C. grimesiana* and its allies (except *C. cylindrocalyx*) are unique in the genus (and unusual in the subfamily as a whole) in having trichomes at the apex of all five anthers. The two novelties bear apical trichomes only on the ventral pair of anthers.

In point of fact, there is no *a priori* reason to restrict the search for relatives of *C. duvalliorum* and *C. maritae* to species with dissected adult foliage. The available evidence suggests that deeply dissected adult foliage has evolved several times within *Cyanea* (Carlquist, 1974; Lammers, 1990a, 1990b; Givnish et al., 1994, 1995). *Cyanea aspleniifolia* and *C. shipmanii* are related to species with toothed leaves, including *C. dunbariae* Rock and *C. profuga* C. N. Forbes (Lammers, 1990b), while the closest relative of the *C. grimesiana* complex appears to be *C. lobata* H. Mann, in which the adult leaves are merely lobed (Lammers, 1990a). For these reasons, species with non-dissected foliage must also be considered as potential relatives of the novelties.

Detailed consideration of the entire genus revealed that there are two informal species groups in addition to the *C. grimesiana* complex, which are characterized by many of the same features found in *C. duvalliorum* and *C. maritae*: frequent production of prickles; relatively well developed bracts; relatively large white flowers; corolla tubes stout, arcuate, laterally compressed, and tallest above the middle; and orange or yellow berries crowned by the persistent calyx lobes.

The first consists of the ten species formerly segregated as the genus *Rollandia* (Lammers et al., 1993; Lammers, 1998a): *C. calycina* (Chamisso) Lammers; *C. crispa* (Gaudichaud) Lammers, Givnish & Sytsma; *C. humboldtiana* (Gaudichaud) Lammers, Givnish & Sytsma; *C. koolauensis* Lammers, Givnish & Sytsma; *C. lanceolata* (Gaudichaud) Lammers, Givnish & Sytsma; *C. longiflora* (Wawra) Lammers, Givnish & Sytsma; *C. parvifolia* (C. N. Forbes) Lammers, Givnish & Sytsma; *C. purpurellifolia* (Rock) Lammers, Givnish & Sytsma; *C. sessilifolia* (O. Degener) Lammers; and *C. st.-johnii* (Hosaka) Lammers, Givnish & Sytsma. These plants are unique within the genus in the dorsal adnation of the filament tube to the corolla tube and further differ from the *C. grimesiana* complex in their lack of dissection of the adult foliage; margins are entire or more often merely toothed. However, this complex does show some developmental dimorphism. Four species (*C. calycina*, *C. lanceolata*, *C. longiflora*, and *C. sessilifolia*) produce distinctive juveniles, though in these the margins of the juvenile leaves are merely lobed rather than parted or divided. Biogeographically, the species of the *Rollandia* complex are all endemic to O'ahu, except for *C. parvifolia*, which is endemic to Kaua'i; no representatives occur on or near East Maui.

The second informal group consists of five species found on the two youngest islands of the archipelago: *C. glabra* (E. Wimmer) St. John, *C. longissima* (Rock) H. St. John, *C. mceldowneyi* Rock (all from East Maui), *C. platyphylla* (A. Gray) Hillebrand (windward Hawai'i), and *C. scabra* Hillebrand (West Maui). Like the *Rollandia* complex, the *C. scabra* complex differs from the *C. grimesiana* complex in its lack of dissection of adult foliage and the presence of developmental dimor-

phism. As before, the species that do produce distinctive juveniles (*C. glabra*, *C. mceldowneyi*, and *C. platyphylla*) bear leaves that are merely lobed rather than parted or divided.

The relationships of *C. duvalliorum* and *C. maritae* lie somewhere among these three informal groups. Of them, the *Rollandia* complex seems the most distantly related to *C. duvalliorum* and *C. maritae*. None of its species has leaves, adult or juvenile, that even approach the two novelties in degree of dissection, while the novelties lack the unique adnation of the staminal column that characterizes the group; furthermore, the species of the *Rollandia* complex occur three or four islands away in a very different biogeographic setting. The *C. grimesiana* and *C. scabra* complexes lack this adnation of the staminal column and are represented on East Maui.

It is more difficult to decide between the *C. grimesiana* and *C. scabra* complexes, because their distinctness is blurred to some extent by *C. duvalliorum* and *C. maritae*. Though the *C. grimesiana* complex would seem more similar to the novelties due to its dissected adult foliage, it does not show any tendency toward developmental dimorphism. This seems to me to reflect a fundamental difference in life history. Furthermore, the novelties differ from *C. grimesiana* and most of its allies in their lack of apical pubescence on the three dorsal anthers. This feature is unique to these species within *Cyanea* (and very rare in the subfamily) and seems a valuable indicator of affinity. Biogeographically, this complex is represented on East Maui by just one of its five species.

Though the *C. scabra* complex shows no dissection of the adult lamina, three of its five species do produce distinctive juveniles. In all its species, the anthers bear trichomes only on the ventral pair, as in the novelties. Furthermore, East Maui is the center of diversity for this complex, with three of its five species endemic there. Overall, *C. duvalliorum* and *C. maritae* do seem more closely related to the members of the *C. scabra* complex.

Within this complex, one would assume that the two new species are each other's closest relative, as they are the only members of the group with parted or divided adult leaves. Of the species described previously, *C. scabra* and *C. mceldowneyi* seem most closely related to the two novelties, based on their common possession of persistent narrowly oblong bracts and calyx lobes, rounded at apex (see key below).

It is noteworthy that *C. duvalliorum* possesses a feature unique in the genus: the concrescence of the apical trichomes on the ventral anthers into a triangular scale. An identical scale, formed in the same manner, characterizes a Latin American taxon of Lobelioideae, *Centropogon* C. Presl subg. *Centropogon* (Lammers, 1998b). Like the branched trichomes found in *Cyanea calycina* and *Centropogon* sect. *Siphocampyloides* Bentham (Lammers, 1998b, 2002; Batterman & Lammers, in press), this is apparently a case of parallel evolution.

Although the plants discovered at Wai'ohiwi Stream could not be equated with any named species, they do appear to match a number of specimens collected on East Maui by earlier botanists. These specimens were sterile or otherwise inadequate for confident identification, and languished in herbaria under various names for many years.

Of these earlier specimens, *Rock 8797*, *8797a*, and *8798* served as paratypes of *C. scabra* var. *variabilis* Rock. Although these gatherings are referable to *C. duvalliorum* (*8797*) and *C. maritae* (*8797a*, *8798*), the holotype of *C. scabra* var. *variabilis* is a specimen of *C. longissima* and that name is properly treated as a synonym of this species. Previously (Lammers, 1990a), all these paratypes were regarded as juveniles of *C. glabra*. However, I subsequently realized that the leaf margin of true juvenile *C. glabra* (e.g., *Forbes 1657.M*, BISH, K, L, RSA, S) is only shallowly lobed, not deeply dissected.

The remainder of the early sterile collections of *C. duvalliorum* had been identified tentatively as *C. horrida*. Though these two species are very similar in morphology of both juvenile and adult leaves, sterile specimens may be distinguished on the basis of pubescence. In *C. horrida*, the leaves are sparsely pubescent adaxially and more densely so abaxially; in *C. duvalliorum*, pubescence is confined to the abaxial venation or totally absent.

These earlier collections considerably extend the distributional range of both *C. duvalliorum* and *C. maritae* on the windward slopes of Haleakalā. Some were collected 7–12 km east of Wai'ohiwi Stream, from Honomanū Stream to Wailua Iki Stream; others were obtained approximately 25 km east, at Kīpahulu Valley. Efforts should be made to ascertain whether any of these populations is still extant.

Cyanea duvalliorum Lammers & H. Oppenheimer, sp. nov. Type: U.S.A. Hawaiian Islands: East Maui, Makawao District, Ko'olau Forest Reserve, Wai'ohiwi, 20°50′04″N, 156°15′55″W, mesic forest, steep shady slope, 2800 ft., 15 Oct. 2000, *H. Oppenheimer & F. Duvall H100026* (holotype, BISH [sheet plus liquid]; isotypes, B, K, MO, NY, OSH, PTBG, US). Figure 2.

Species ob marginem foliorum maturorum pinnatim fis-

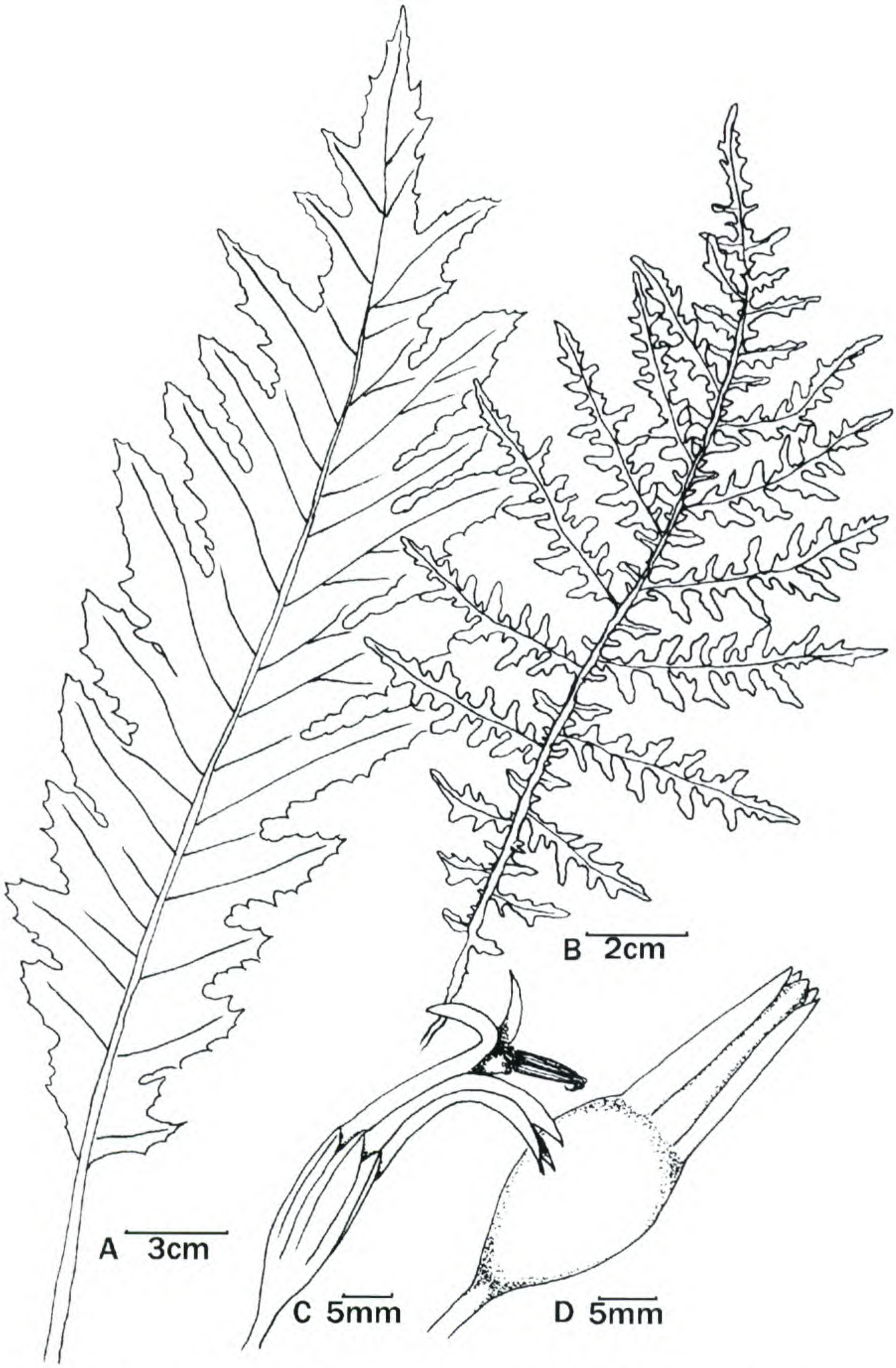

Figure 2. *Cyanea duvalliorum* Lammers & H. Oppenheimer. —A. Adult leaf. —B. Juvenile leaf. —C. Flower. —D. Fruit. (A, C drawn from the holotype, *Oppenheimer & Duvall H100026*; B, D drawn from a paratype, *Oppenheimer et al. H10003*.)

sum partitum vel divisum et corollae tubum compressum arcuatum supra medium altissimum affinitatem *Cyaneae grimesianae* simulans, sed ob plantas juveniles proprias et tubum antherarum cum trichomatibus apicalibus solum in pari ventrali gregem *C. scabrae* vero pertinet; inter *C. scabram* et species affines habitu arboreo 4–6 m alto, margine foliorum maturorum pinnatim partito vel fisso basin versus pinnato, bracteolis longioribus 4–5 mm longis, bracteis longioribus 10–13 mm longis, calycis lobis longioribus 13–19 mm longis, corolla hypanthio triplo vel quadruplo longiore, staminali columna pubescenti, tubo filamentorum antheris dorsalibus triplo longiore, antheris dorsalibus longioribus 11–12 mm longis, antheris ventralibus ad apicem squama triangularis formata trichom-

atibus concrescentibus, et baccis longioribus 17–21 mm longis distinguenda.

Trees, 4–6 m tall, producing distinctive juveniles but these not flowering precociously; stems of juveniles 0.7–1.2 cm diam., unbranched, armed with numerous prickles consisting of a sharp trichome atop a bulbous multicellular base; stems of adults 1.6–2 cm diam. below the leaves and inflorescences, 4–21 cm diam. at base, branching about 1 m above ground, the 4 to 11 branches diverging from trunk at a 45°–60° angle, ascending, sometimes branching sparingly once again, armed with stout conic prickles below, becoming smooth toward apex, sometimes producing short shoots with juvenile foliage; latex white. *Juveniles* with lamina elliptic or oblanceolate, 13–27 cm long, 7–17 cm wide across the segments, 0.2–0.4 cm wide between the segments; upper surface dark green and glabrous; lower surface light green, glabrous, armed with prickles consisting of a sharp trichome atop a bulbous multicellular base; margin pinnately divided, becoming pinnately compound at base, the segments oblong or elliptic, 1–9 × 0.7–2.8 cm, 8 to 10 per side, separated by sinuses, their margin pinnately lobed, cleft, parted, or divided (these secondary segments oblong or narrowly triangular, 2–18 × 2–10 mm, the apex obtuse); apex obtuse; petiole 3–4 cm long, 0.2–0.3 mm diam., 1/7–1/3 as long as the lamina, armed with prickles consisting of a sharp trichome atop a bulbous multicellular base. *Adults* with lamina elliptic or oblanceolate, 31–53 cm long, 10–20 cm wide across the segments, 0.5–4.7 cm wide between the segments; upper surface dark green and glabrous; lower surface light green and pubescent on veins with short stiff curved hairs; margin pinnately parted or divided, becoming pinnately compound at base, the segments oblong or elliptic, 1.5–12.5 × 0.5–4 cm, 10 to 14 per side, separated by sinuses, their margin pinnately cleft or parted (these secondary segments deltate or triangular, 2–22 × 2–18 mm, the apex acute or acuminate); apex acute or acuminate; petiole 4.5–6.5 cm long, 3.5–9 mm diam., 1/10–1/8 as long as the lamina, minutely pubescent. Racemes 6- to 10-flowered, arising below the apical rosette of leaves, the flowers all blooming ± simultaneously; peduncle and rachis horizontal, 35–54 mm long, 4–9 mm diam., glabrous; bracts narrowly oblong, 10–13 × 1.5–1.6 mm, subtending the pedicels, sometimes a few empty ones on the peduncle, deciduous, rounded at apex; pedicels ascending, 9–14 mm long, 0.8–1 mm diam., medially or subapically bibracteolate, glabrous; bracteoles narrowly oblong, 4–5 × 0.8–1.2 mm. Hypanthium obconic, 10–12 mm long, 5–9 mm diam., 1/5–1/3 as long as the corolla, glabrous, attenuate at base; calyx lobes narrowly oblong, 13–19 × 2.6–5 mm, abutting at base but distinct, erect, glabrous, the margin entire, rounded and apiculate at apex; corolla white, 38–47 mm long, glabrous; corolla tube arcuate, laterally compressed, 23–28 mm long, 5–6 mm tall at base, narrowing gradually to 3–4 mm tall at mouth, cleft dorsally for ca. half its length; dorsal corolla lobes spreading, 16–19 × 1 mm, ca. 2/3 as long as tube; ventral corolla lobes deflexed, 13–15 × 1 mm; filament tube 32–40 mm long, 1.3–1.5 mm diam., pubescent with long white hairs, free from the corolla; anther tube gently decurved, 2.3–2.7 mm diam., densely pubescent at base and on the connectives; dorsal anthers 11–12 mm long, ca. 1/3 as long as the filament tube; ventral anthers 7.5–8.5 mm long, their apex crowned by a triangular scale 3–4.5 mm long, formed from loosely concrescent white trichomes. Berries bright orange, ellipsoid, 17–21 mm long, 10–15 mm diam., crowned by the persistent calyx lobes; seeds brown, broadly ellipsoid, 0.7 mm long, 0.5 mm diam., the testa Type C of Murata (1992, 1995), smooth, shiny.

Distribution, habitat, and phenology. Endemic to windward East Maui in the Hawaiian Islands. Recent fertile collections are from mesic forests on the northwestern slopes of Haleakalā in the Wai'ohiwi watershed at an elevation of 855 m; more than 50 mature trees and numerous juveniles were observed here during 2000–2002. Sterile collections were obtained from the same general region and points to the east at slightly higher elevations (1070–1522 m) in 1911, 1920, 1927, and 1980. Sterile specimens were also collected farther east, at Kīpahulu Valley, in 1919. This species flowers during October, and the fruits ripen during December and January.

Etymology. *Cyanea duvalliorum* is named for two of its discoverers, ornithologists Renate Gassmann-Duvall (b. 1946) and her husband Fern Duvall (b. 1953), who are extremely active in the Hawaiian conservation community. They have brought the new species (and others) into cultivation and taken the lead in securing its preservation.

Paratypes. U.S.A. Hawaiian Islands. East Maui. **Makawao:** above Kula pipe line, *Munro 724A* (BISH); Haleakalā pipe line, *Munro 724B* (BISH, NY, US), *G. C. Munro 725* (BISH); Ha'ikū Uka, Wai'ohiwi Stream, *Oppenheimer et al. H10003* (BISH [2 sheets plus liquid], MO, NY, OSH [sheet plus liquid], PTBG, US); Ha'ikū Uka, tributary of Wai'ohiwi Stream, *Oppenheimer et al. H10012* (BISH, OSH, PTBG); W of 'Ōpana Gulch across stream, *Warshauer & McEldowney 2754* (BISH). **Hāna:** ridge left Kīpahulu, *Forbes 1728.M* (BISH), *Forbes 1729.M* (BISH);

trail E of Ke'anae & up ridge between W & E Wailua Iki, *Forbes 2659.M* (BISH); Ke'anae Valley, *Rock 8797* (BISH).

Cyanea maritae Lammers & H. Oppenheimer, sp. nov. TYPE: U.S.A. Hawaiian Islands: East Maui, Makawao District, Ko'olau F. R., Wai'ohiwi drainage basin, 2800 ft., growing above the confluence of two intermittent tributaries, near the main stream, 20°50′06″N, 156°15′52″W, degraded mesic forest amidst forestry plantings of *Eucalyptus robusta* & *E. globulus*, 26 Nov. 2000, *H. Oppenheimer & F. Duvall H110029* (holotype, BISH; isotypes, OSH, PTBG). Figure 3.

Species ob marginem foliorum maturorum pinnatim fissum partitum vel divisum, calycis lobum et florum bracteam oblongum, et corollae tubum arcuatum compressum affinis *Cyaneae duvalliorum*, sed ab hac specie habitu fruticoso, ramis basalibus paucioribus 2–4 valde assurgentibus, foliis juvenilibus et maturis cum segmentis triangularis serrulatis 5–8 utrobique, petiolis foliorum maturorum proportione longioribus admodum ⅓–½ laminam aequantibus, hypanthio proportione breviore modum ⅐–⅙ corollam aequanti, calycis lobis brevioribus 3.5–9.5 mm longis, corolla longiore 59–61 mm longa cum lobis dorsalibus ⅓–⅖ tubum aequantibus, filamentorum tubo antheris dorsalibus quadruplo vel quintuplo longiore, et baccis parvioribus 12–13 mm longis bene distinguenda.

Shrubs, 2–2.4 m tall, producing distinctive juveniles but these not flowering precociously; stems of juveniles unbranched, armed with numerous prickles consisting of a sharp trichome atop a bulbous multicellular base; stems of adults 0.7–1.5 cm diam. toward apex, 6.3–7.4 cm diam. at base, producing 2 to 4 strongly ascending branches from near the base (sometimes unbranched), armed with stout conic prickles below, becoming smooth toward apex; latex white. *Juveniles* with lamina broadly elliptic, 6.8–15 cm long, 4.6–8.7 cm wide across the segments, 2.3–3.8 cm wide between the segments, both surfaces armed with prickles consisting of a sharp trichome atop a bulbous multicellular base; upper surface dark green; lower surface light green; margin pinnately parted; segments triangular, 0.5–2 × 0.3–1.8 cm, 5 to 8 per side, separated by sinuses, their margin minutely serrulate, acuminate at apex; apex acuminate; base truncate; petiole 2–4.7 cm long, 1.2–2 mm diam., ca. ⅓ as long as the lamina, armed with prickles consisting of a sharp trichome atop a bulbous multicellular base. *Adults* with lamina 17–37 cm long, 8.5–19 cm wide across the segments, 1.3–10 cm wide between the segments, elliptic or oblong, both surfaces armed with prickles consisting of a sharp trichome atop a bulbous multicellular base; upper surface dark green; lower surface light green, glabrous or pubescent on veins with short stiff curved hairs; margin pinnately cleft, parted, or divided; segments narrowly triangular, triangular, or deltate, or shallowly triangular, often falcate, 0.6–10 × 0.8–4.5 cm wide, 6 to 8 per side, separated by sinuses, their margin minutely serrulate, acuminate or acute and apiculate at apex; apex acuminate; base cuneate or obtuse; petiole 10–13.5 cm long, 3–4.3 mm diam., ⅓–½ as long as the lamina, sparsely armed with prickles consisting of a sharp trichome atop a bulbous multicellular base. Racemes 9- to 45-flowered over their lifetime, but only 4 to 8 flowers present at any given time, arising within the apical rosette of leaves; peduncle and rachis horizontal, 45–90 mm long, 2.5–4 mm diam., sparsely armed with prickles consisting of a sharp trichome atop a bulbous multicellular base; bracts oblong, 1.5–2.2 × 0.8–1 mm, subtending the pedicels, deciduous, rounded or obtuse at apex; pedicels spreading, 12–25 mm long, 0.9–1 mm diam., ebracteolate, glabrous. Hypanthium campanulate or obconic, 9–9.5 mm long, 7–9 mm diam., ⅐–⅙ as long as the corolla, glabrous, cuneate at base; calyx lobes oblong, 3.5–9.5 × 1.5–3 mm, abutting at base but distinct, erect, glabrous, the margin entire, acute or rounded and apiculate at apex; corolla white tinged with pink, 59–61 mm long, sparsely pubescent, especially on the lobes; corolla tube arcuate, laterally compressed, 42–46 mm long, 5–6.3 mm tall at base, increasing to 7–9.2 mm tall above the middle before decreasing to 3.8–5.5 mm tall at mouth, cleft dorsally for ca. ½ its length; dorsal corolla lobes spreading, 14–18 × 1.5–2 mm, ⅓–⅖ as long as tube; ventral corolla lobes deflexed, 11–14 × 0.9–1.7 mm, connate basally for 5–6 mm; filament tube 50–51 mm long, 1.8–2.1 mm diam., glabrous, free from the corolla; anther tube gently decurved, 2.8–3.4 mm diam. at base, tapering to 1.5–2 mm diam. at mouth, glabrous; dorsal anthers 11–12.5 mm long, ⅕–¼ as long as the filament tube; ventral anthers 8–9 mm long, their apex crowned by a tuft of white trichomes 2.5–3 mm long. Berries yellowish orange, broadly ellipsoid or obovoid, 12–13 mm long, 8.5–10.5 mm diam., crowned by the persistent calyx lobes; seeds brown, broadly ellipsoid, 0.7 mm long, 0.5 mm diam., the testa Type C of Murata (1992, 1995), smooth, shiny.

Distribution, habitat, and phenology. Endemic to windward East Maui in the Hawaiian Islands. Recent fertile collections are from mesic forests on the northwestern slopes of Haleakalā in the Wai'ohiwi watershed at an elevation of 855 m; less than 20 adult and juvenile plants were observed here during 2000–2002. Sterile specimens were collected from the same general region and points

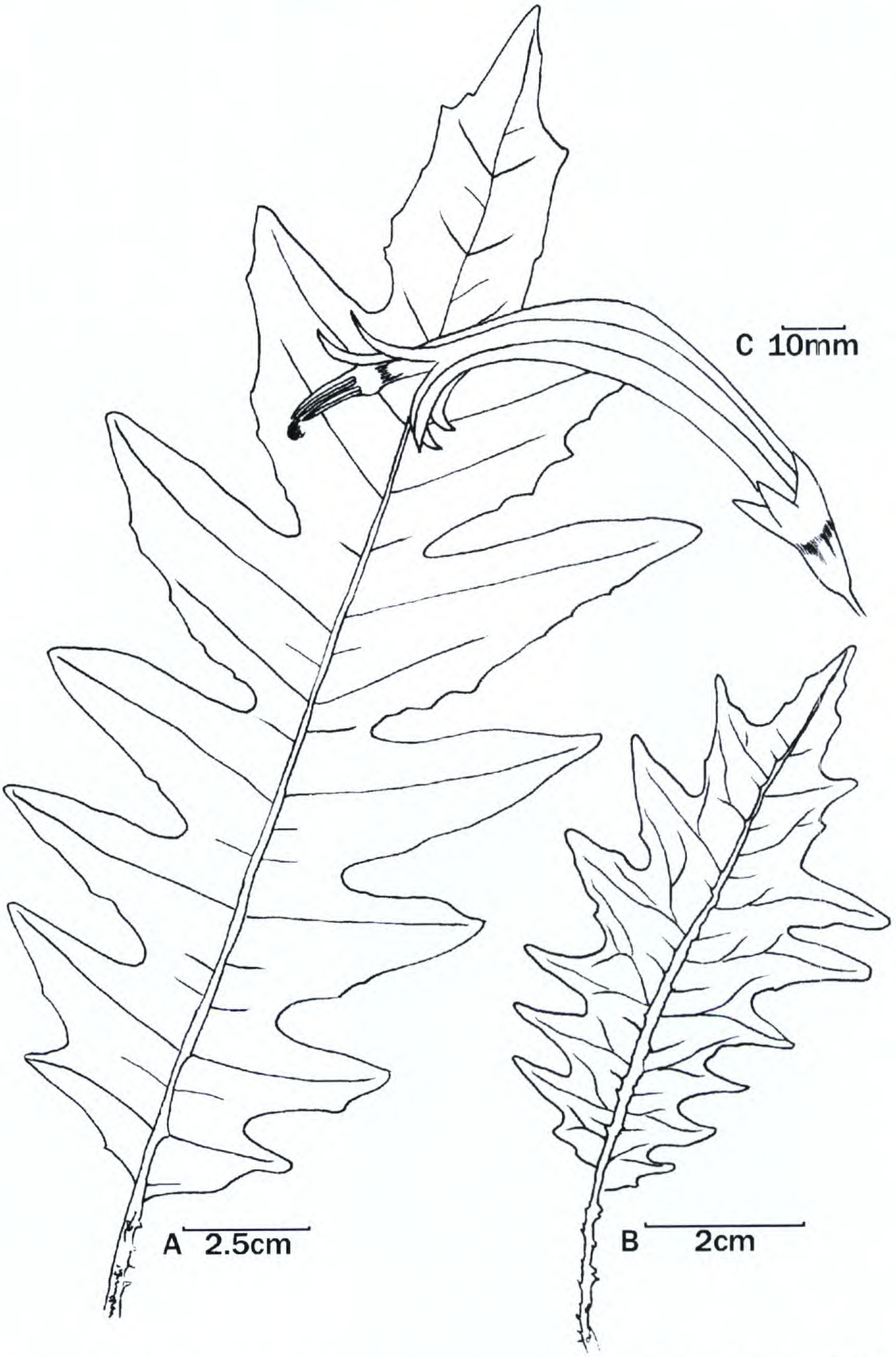

Figure 3. *Cyanea maritae* Lammers & H. Oppenheimer. —A. Adult leaf. —B. Juvenile leaf. —C. Flower. (A, C drawn from the holotype, *Oppenheimer & Duvall H110029*; B drawn from a paratype, *Oppenheimer & Duvall H10005*.)

to the east in 1911, and farther east at Kīpahulu Valley in 1919. This species flowers during November and December, and the berries ripen by May.

Etymology. This species is named in honor of one of its discoverers, Marita Oppenheimer née Lewis (b. 1957), long-time Maui resident and avid hiker.

Paratypes. U.S.A. Hawaiian Islands. East Maui. **Makawao**: Ha'ikū Uka, Wai'ohiwi Stream, *Oppenheimer & Duvall H10005* (BISH, OSH, PTBG); Ha'ikū Uka, Wai'ohiwi

Stream, *Oppenheimer & Duvall H10005B* (BISH, K, NY, OSH, PTBG). **Hāna:** ridge left side Kīpahulu Valley, *Forbes 1636.M* (BISH), *Forbes 1680a.M* (BISH); Honomanū Valley, *Rock 8797a* (BISH, GH); Ke'anae Valley, *Rock 8798* (BISH, GH).

The species of the *Cyanea scabra* complex as defined above may be distinguished using the following key. In the most recent key to the genus (Lammers, 1990a), this may be substituted for couplets 48–51 on p. 443.

KEY TO THE SPECIES OF THE HAWAIIAN *CYANEA SCABRA* COMPLEX

1a. Bracts oblong, their apex obtuse; calyx lobes oblong, their apex rounded, truncate, or emarginate, often apiculate.
  2a. Margin of adult lamina cleft, parted, or divided.
    3a. Trees, 4–6 m tall; stems branching at least 1 m above the base, producing 4 to 11 spreading branches; juvenile leaves with 8 to 10 oblong or elliptic segments per side, the margin of these segments lobed, cleft, parted, or divided; adult leaves with 10 to 14 oblong or elliptic segments per side, the margin of these segments cleft or parted; petiole of adult leaves 4.5–6.5 cm long, 1/10–1/8 as long as the lamina; bracts 10–13 × 1.5–1.6 mm; hypanthium 1/5–1/3 as long as corolla; calyx lobes 13–19 mm long; corolla 38–47 mm long, the dorsal lobes ca. 2/3 as long as the tube; filament tube 32–40 mm long, ca. 3 times longer than the dorsal anthers, pubescent; anther tube 2.3–2.7 mm diam., densely pubescent at base and on connectives; ventral anthers tipped by a triangular scale of concrescent trichomes 3–4.5 mm long; berries 17–21 mm long, 10–15 mm diam. (East Maui) . . . . . *C. duvalliorum*
    3b. Shrubs, 2–2.4 m tall; stems branching near base, producing 2 to 4 strongly ascending branches (rarely unbranched); juvenile leaves with 5 to 8 triangular segments per side, the margin of these segments serrulate; adult leaves with 6 to 8 narrowly triangular, triangular, deltate, or shallowly triangular segments per side, the margin of these segments serrulate; petiole of adult leaves 10–13.5 cm long, 1/3–1/2 as long as the lamina; bracts 1.5–2.2 × 0.8–1 mm; hypanthium 1/7–1/6 as long as corolla; calyx lobes 3.5–9.5 mm long; corolla 59–61 mm long, the dorsal lobes 1/3–2/5 as long as the tube; filament tube 50–51 mm long, 4–5 times longer than the dorsal anthers, glabrous; anther tube 2.8–3.4 mm diam., glabrous; ventral anthers tipped by a tuft of free trichomes 2.5–3 mm long; berries 12–13 mm long, 8.5–10.5 mm diam. (East Maui) . . *C. maritae*
  2b. Margin of adult lamina dentate or denticulate.
    4a. Lamina elliptic or obovate, 2.5–4.5 times as long as the petiole, the base obtuse or rounded; corolla 50–60 mm long, the tube 37–45 mm long, 3–3.8 mm tall at mouth and 4.7–7.3 mm tall near middle; filament tube 43–55 mm long; dorsal anthers 8–8.5 mm long, 1/7–1/5 as long as filament tube; ventral anthers 5.5–6.5 mm long, their apical hairs 3–3.8 mm long (West Maui) . . . . . *C. scabra*
    4b. Lamina narrowly oblong or oblanceolate, 5–9 times as long as the petiole, the base cuneate; corolla 62–65 mm long, the tube 48–51 mm long, 5.5–6.5 mm tall at mouth and 8.2–11 mm tall near middle; filament tube 56–60 mm long; dorsal anthers 5 mm long, 1/12–1/10 as long as filament tube; ventral anthers 4 mm long, their apical hairs 1.5–2 mm long (East Maui) . . . . . *C. mceldowneyi*
1b. Bracts linear, linear triangular, or narrowly triangular, their apex acuminate; calyx lobes triangular or narrowly triangular, their apex acuminate.
  5a. Leaf base long attenuate, narrowing imperceptibly into a winged petiole; corolla tube 45–49 mm long; dorsal anthers 5.3–6 mm long, about 1/10 as long as the filament tube; ventral anthers 4.2–4.9 mm long, their apical hairs 1–1.5 mm long (East Maui) . . . . . *C. longissima*
  5b. Leaf base cuneate or obtuse, rarely rounded, the petiole not winged; corolla tube 26–45 mm long; dorsal anthers 7–10 mm long, 1/8–1/4 as long as the filament tube; ventral anthers 5–8 mm long, their apical hairs 1.7–3.5 mm long.
    6a. Corolla 55–64 mm long, the tube 43–45 mm long, 5.5–8 mm tall at base, 9–11 mm tall near middle, the lobes 1/4–2/5 as long as the tube; filament tube 48–57 mm long; hairs at apex of ventral anthers 1.7–2 mm long (East Maui) . . . . . *C. glabra*
    6b. Corolla 43–56 mm long, the tube 26–39 mm long, 3–5 mm tall at base, 4–9 mm tall near middle, the lobes 2/5–7/8 as long as the tube; filament tube 36–50 mm long; hairs at apex of ventral anthers 2–3.5 mm long (windward Hawai'i) . . . . . *C. platyphylla*

CYANEA SECT. *DELISSEOIDEAE*

As circumscribed by Rock (1919), *Cyanea* sect. *Delisseoideae* (Hillebrand) Rock comprises those members of the genus that are shrubs or treelets 0.3–5 m tall (rarely small branched trees to 7 m tall) with stems 0.5–2.5 cm in diameter just below the apex, totally lacking prickles, with entire or toothed leaves, minute deciduous triangular bracts, bibracteolate pedicels, minute calyx lobes, hypanthium only 1/10–1/5 as long as the relatively small, slender, suberect or gently curved white corolla,

purple berries, and small minutely papillose seeds (Type F testa; Buss et al., 2001). Of the species recognized in the most recent treatment of the genus (Lammers, 1990a) and its supplements (Lammers & Lorence, 1993; Lammers, 1998a), the following are referable to section *Delisseoideae*: *C. angustifolia* (Chamisso) Hillebrand (lectotype of the section; St. John, 1969), *C. asarifolia* H. St. John, *C. coriacea* (A. Gray) Hillebrand, *C. dolichopoda* Lammers & Lorence, *C. elliptica* (Rock) Lammers, *C. fauriei* H. Léveillé, *C. habenata* (H. St. John) Lammers, *C. hardyi* Rock, *C. kahiliensis* (H. St. John) Lammers, *C. linearifolia* Rock, *C. mannii* Brigham, *C. membranacea* Rock, *C. obtusa* (A. Gray) Hillebrand, and *C. spathulata* (Hillebrand) A. Heller.

In my earlier treatment, I followed Rock (1917, 1919) in recognizing *C. coriacea* and *C. fauriei* as distinct and largely allopatric species, distinguished primarily by inflorescence length: plants of northern Kaua'i with short spreading or ascending condensed racemes were called *C. coriacea*, while plants of southern Kaua'i with long pendent elongate racemes were called *C. fauriei*. However, field studies on Kaua'i in 1991 and detailed examination of a larger body of herbarium specimens convinced me that many of the long-racemed plants I had identified as *C. fauriei* were otherwise indistinguishable from *C. coriacea*. Variation in raceme length among these plants is continuous and essentially clinal. In northern Kaua'i (e.g., on the Nāpali Coast) are found populations with relatively short often ascending racemes (cf. Rock, 1919, pl. 109). These lengthen as one proceeds south, reaching their greatest development with the highly elongate and pendent racemes found in Olokele Canyon (cf. Rock, 1919, pl. 110). It is worth noting that Rock himself had earlier (Rock, 1913, 1914) treated the two names as synonymous, while Wimmer (1943) treated *C. fauriei* as a variety of *C. coriacea*, a classification embraced by Degener and Degener (1956) and St. John (1973, 1980).

However, not all specimens that I had identified as *C. fauriei* resemble *C. coriacea*. Many of the plants with relatively long pendent racemes differ from *C. coriacea* in a number of characteristics, including slimmer twigs and smaller leaves. In these features, they more closely resemble *C. hardyi*; in fact, some of these specimens were previously identified as that species. However, these smaller-leaved plants differ from *C. hardyi* in several features, including their broader leaf base, shorter rachis and pedicels, shorter hypanthium and calyx lobes, and shorter filament tube. Furthermore, one specimen previously identified as *C. fauriei* differs from all these plants in its extremely small flowers, e.g., hypanthium only 2.3–2.7 mm long, corolla just 15–16.5 mm long, filament tube 12–14 mm long, and anthers (dorsal pair) 4.5–5 mm long. In fact, these are the smallest known flowers in the entire genus, by a significant margin. It thus appears that three distinct species were confounded under the name *C. fauriei*: the long-racemed southern populations of *C. coriacea*, plants with slimmer twigs and smaller leaves resembling *C. hardyi*, and a plant with the smallest flowers in the genus.

In order to determine which of these takes the name *C. fauriei*, it was first necessary to clarify the typification of that name. In the protologue, Léveillé cited two gatherings: "Kauai: Koloa; Waimea, 1000 m, dec. 1909, mart. 1910, (Faurie, 565, 591)." These are thus syntypes from which a lectotype must be selected. Rock (1913, 1914, 1919) apparently only saw *Faurie 565*, but never referred to it as the type. Wimmer (1943) saw both gatherings and specifically excluded *Faurie 591* from *C. coriacea* var. *fauriei* by referring it to *C. coriacea* var. *hardyi* (Rock) E. Wimmer, a homotypic synonym of *C. hardyi*. Like Rock, he did not specifically state that *Faurie 565* was the type of *C. fauriei*. As a result, neither action can be interpreted as an effective lectotypification under Article 7.11 of the ICBN (Greuter et al., 2000).

The specimens upon which Léveillé based his new taxa were deposited in his personal herbarium, which was sold to E in 1919 (Stafleu & Cowan, 1979). Staff members of that institution have compiled a catalogue of all names ever published by Léveillé, together with information on typification (cf. Lauener, 1983). In this catalogue, every one of the Hawaiian Lobelioideae is listed as "typus—n[on]. v[idi].," even though types for nearly all Chinese Campanulaceae were seen (Chamberlain, 1977). Indeed, when I requested a loan of Léveillé's Hawaiian lobelioid types from E in 1985, I received only a set of photographs showing specimens at BM, and a note stating that no actual specimens were to be found at E. Lauener (1980) referred to the specimens at BM as isotypes (or syntypes, if two or more numbers had been cited in the protologue), but they appear to be the original specimens from Léveillé's personal herbarium. I have been unable to discover why these specimens are at BM and not E with the remainder of Léveillé's personal herbarium.

In any event, both *Faurie 565* and *Faurie 591* were found at BM, each represented by a photograph at E. As noted by Wimmer (1943), the latter gathering does not conform to the original diagnosis of *C. fauriei* and is referable to *C. hardyi*. For this

reason, *C. fauriei* is here lectotypified on the basis of *Faurie 565*, which does conform to the diagnosis. Because this specimen represents the long-racemed southern populations of *C. coriacea*, this binomial is here treated as a synonym of *C. coriacea* (following Rock, 1913, 1914), along with several varieties of that species that do not merit recognition (cf. Lammers, 1990a). All are listed here for clarity.

Cyanea coriacea (A. Gray) Hillebrand, Fl. Hawaiian Isl. 254. 1888. *Delissea coriacea* A. Gray, Proc. Amer. Acad. Arts 5: 147. 1861. TYPE: U.S.A. Hawaiian Islands: Kaua'i, 1851–1855, *J. Rémy 302* (holotype, GH; isotypes, A, L, P[5], Z).

Cyanea fauriei H. Léveillé, Repert. Spec. Nov. Regni Veg. 10: 156. 1911. *Cyanea coriacea* var. *fauriei* (H. Léveillé) E. Wimmer, Pflanzenr. IV.276b: 72. 1943. *Delissea fauriei* (H. Léveillé) H. St. John, Phytologia 63: 342. 1987; non H. Léveillé, Repert. Spec. Nov. Regni Veg. 12: 505. 1913. TYPE: U.S.A. Hawaiian Islands: Kaua'i, Kōloa, Dec. 1909, *U. Faurie 565* (lectotype, selected here, BM, photograph, E; isolectotypes, A, BISH, G, P, W).

Cyanea coriacea var. *degeneriana* E. Wimmer, Pflanzenr. IV.276b: 761. 1953. *Delissea coriacea* var. *degeneriana* (E. Wimmer) H. St. John, Phytologia 63: 82. 1987. TYPE: U.S.A. Hawaiian Islands: Kaua'i, ridge behind Pāpa'a, 16 Jan. 1952, *O. Degener & A. Greenwell 21736a* (holotype, W; isotypes, B[2]).

Delissea coriacea var. *deltoidea* H. St. John, Phytologia 63: 340. 1987. Syn. nov. *Delissea perlmanii* H. St. John, Phytologia 63: 346. 1987 (as 'perlmannii'). TYPE: U.S.A. Hawaiian Islands: Kaua'i, Limahuli Valley, common, 8 Sep. 1977, *S. Perlman 1* (holotype, BISH; isotypes, BISH[2]).

Delissea coriacea var. *haupuensis* H. St. John, Phytologia 63: 340. 1987. Syn. nov. TYPE: U.S.A. Hawaiian Islands: Kaua'i, Hoary Head Range, near 1286 ft. peak N of Lā'aukahi, E side of range, dryland forest, 1100 ft., 3 Nov. 1976, *C. Christensen 91* (holotype, BISH; isotype, BISH).

Delissea coriacea var. *lumahaiensis* H. St. John, Phytologia 63: 340. 1987. TYPE: U.S.A. Hawaiian Islands: Kaua'i, road between Hanalei & Lumaha'i, Sep. 1913, *C. N. Forbes & H. J. Forbes 464.K* (holotype, BISH; isotypes, BISH, GB, K, NY, P, UC, US).

The two sets of populations that were formerly identified as *C. fauriei* but are not referable to *C. coriacea* are described here as new species. Though no names at species rank are available, a name at the rank of *forma* is referable to one species as here circumscribed. However, I explicitly decline to take up this epithet. Though its type falls within the circumscription of the species, its original description does not address the characters emphasized here. For the sake of clarity and precision, I prefer to exercise my prerogative and treat the species as new, with its own diagnosis.

Cyanea pseudofauriei Lammers, sp. nov. TYPE: U.S.A. Hawaiian Islands: Kaua'i, Kōloa District, Līhu'e-Kōloa Forest Reserve, along ridge ESE of Pu'u Kolo, lower ridge in diverse forest with rather stunted vegetation on the windward slopes of the ridge, common on windward slope, elev. 1200–1700 ft., 21 Sep. 1988, *T. Flynn, G. Kawakami & R. Nagata 3144* (holotype, F; isotype, PTBG). Figure 4A, B.

Cyanea coriacea f. *gratiosa* E. Wimmer, Pflanzenr. IV.276b: 760. 1953. *Delissea coriacea* var. *gratiosa* (E. Wimmer) H. St. John, Phytologia 63: 82. 1987. TYPE: U.S.A. Hawaiian Islands: Kaua'i, ridge behind Pāpa'a, Moloa'a Forest Reserve, 16 Jan. 1952, *O. Degener & A. Greenwell 21737* (lectotype, selected here, B; isolectotype, W).

The protologue of *Cyanea coriacea* f. *gratiosa* cited "Kauai: Ridges behind Papaa in lower forest, 16. I. 1952 (Hb. Deg. n. 21736! common form, 21737! rare form intermediate in coloration betw. n. 21736 and n. 21738)." I have seen sheets of *Degener & Greenwell 21737* at B and W, of which the former was annotated "Holotypus" by Wimmer; and sheets of *Degener & Greenwell 21736* at B and BISH, both of which were annotated "Paratypus" by Wimmer. In accordance with Recommendation 9A.3 of the ICBN (Greuter et al., 2000), the B sheet of the former is designated as the lectotype.

Species affinis *Cyaneae coriaceae* et *C. hardyi*, sed caulibus 0.7–1.1 cm diametro apicem versus, lamina 11.5–24.5 cm longa 2.8–5.5 cm lata anguste elliptica vel oblanceolata basi cuneata, pedunculo 20–75 mm longo, rhachidi 8–40 mm longa, hypanthio 3–5 mm longo late ellipsoidali vel hemisphaerico, calycis lobis 0.3–0.8 mm longis 0.3–0.4 mm latis, corollae tubo 3.5–4 mm diametro basi 2–2.5 mm diametro in medio, et tubo filamentorum 18–21 mm longo distinguenda.

Shrubs or treelets, 0.9–3.7 m tall; stems unbranched or sparingly branched, 0.7–1.1 cm diam. at apex, glabrous; pith chambered; latex white. Lamina narrowly elliptic or oblanceolate, 11.5–24.5 × 2.8–5.5 cm; upper surface light green, glabrous; lower surface whitish green, pubescent along the midrib or nearly glabrous; margin crenulate; apex obtuse or acute; base cuneate; petiole 2.5–11 cm long, 1.2–2.5 mm diam., ⅕–½ as long as the lamina, glabrous. Racemes 9- to 30-flowered; peduncle ascending when short, decurved when long, 20–75 mm long, 0.8–1.2 mm diam., glabrous; rachis 8–40 mm long, glabrous; bracts triangular or deltate, 0.7–1.4 × 0.7–1 mm, pubescent, deciduous, subtending the pedicels, acute or acuminate at apex; pedicels ascending, 9–14 mm long, 0.3–0.6 mm diam., glabrous, bibracteolate at a point ⅓–½ the distance above the base; bracteoles linear, 0.5–

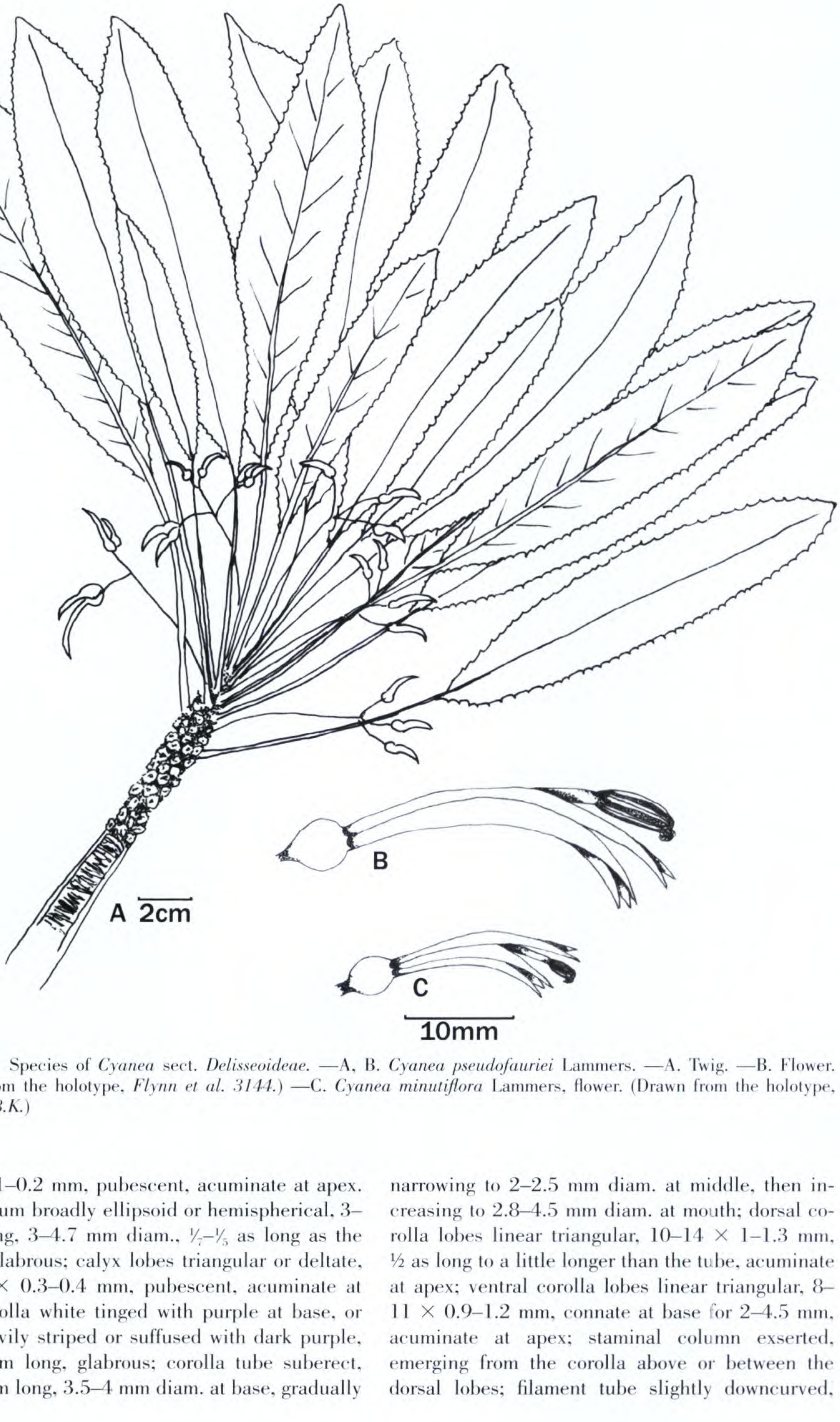

Figure 4. Species of *Cyanea* sect. *Delisseoideae*. —A, B. *Cyanea pseudofauriei* Lammers. —A. Twig. —B. Flower. (Drawn from the holotype, *Flynn et al. 3144.*) —C. *Cyanea minutiflora* Lammers, flower. (Drawn from the holotype, *Forbes 568.K.*)

0.8 × 0.1–0.2 mm, pubescent, acuminate at apex. Hypanthium broadly ellipsoid or hemispherical, 3–5 mm long, 3–4.7 mm diam., 1/7–1/5 as long as the corolla, glabrous; calyx lobes triangular or deltate, 0.3–0.8 × 0.3–0.4 mm, pubescent, acuminate at apex; corolla white tinged with purple at base, or more heavily striped or suffused with dark purple, 25–31 mm long, glabrous; corolla tube suberect, 13–19 mm long, 3.5–4 mm diam. at base, gradually narrowing to 2–2.5 mm diam. at middle, then increasing to 2.8–4.5 mm diam. at mouth; dorsal corolla lobes linear triangular, 10–14 × 1–1.3 mm, ½ as long to a little longer than the tube, acuminate at apex; ventral corolla lobes linear triangular, 8–11 × 0.9–1.2 mm, connate at base for 2–4.5 mm, acuminate at apex; staminal column exserted, emerging from the corolla above or between the dorsal lobes; filament tube slightly downcurved,

18–21 mm long, 0.8–1.2 mm diam., glabrous; anther tube slightly downcurved, 1.7–2.2 mm diam., the surfaces glabrous; dorsal anthers 7–8 mm long, ⅓–⅖ as long as the filament tube; ventral anthers 5–6.5 mm long, with tufts of hairs 1.2–2.2 mm long at apex. Berries purple, globose, 6–8 mm long, 6–8 mm diam.; seeds orangish brown, ellipsoid, 0.8–1 mm long, 0.5–0.7 mm diam., the testa minutely papillose (Type F; Buss et al., 2001), shining.

Additional illustrations. Degener and Degener (1956), left side of plate [as *C. coriacea* f. *gratiosa*]; Buss et al. (2001), fig. 28 [seed only].

Distribution, habitat, and phenology. Endemic to Kaua'i in the Hawaiian Islands, growing in mesic forest at elevations of 165–640 m. Flowering September through December, the fruit beginning to ripen in December.

Etymology. The specific epithet refers to the fact that many specimens were previously identified as *Cyanea fauriei*; from the Latin prefix *pseudo-*, false, and the specific epithet.

Relationships. *Cyanea pseudofauriei* differs from *C. coriacea* (including *C. fauriei*) by its more slender twigs (0.7–1.1 vs. 1.4–2.5 cm diam.); laminas smaller (11.5–24.5 vs. 18–39 cm long, 2.8–5.5 vs. 5.5–11.2 cm wide) and narrowly elliptic or oblanceolate (vs. oblong or broadly elliptic); hypanthium broadly ellipsoid or hemispherical (vs. obovoid or campanulate); and its basally more slender corolla tube (3.5–4 vs. 4–5.5 mm diam.).

Some specimens referable to the new species were identified previously as *C. hardyi*. However, *C. pseudofauriei* differs from that species in its cuneate (vs. attenuate) leaf bases; shorter rachises (8–40 vs. 75–200 mm); shorter pedicels (9–14 vs. 13–22 mm); hypanthium shorter (3–5 vs. 5–6.5 mm) and broadly ellipsoid or hemispherical (vs. obconic or campanulate); shorter calyx lobes (0.3–0.8 vs. 1–1.2 mm); corolla tube more slender (3.5–4 vs. 4.5–5.8 mm diam. at base, 2–2.5 vs. 2.7–4.2 mm diam. at middle); and shorter filament tube (18–21 vs. 20–27 mm). In addition, the mean lengths of both petioles and racemes in *C. pseudofauriei* are significantly less than in the other two species, though there is considerable overlap in the ranges of variation.

These three species are largely sympatric, growing at elevations below 680 m. *Cyanea pseudofauriei* and *C. hardyi* have largely non-overlapping phenologies: the former flowers from September to December, the latter from November to April. *Cyanea coriacea*, however, overlaps both, flowering from late July through January.

Paratypes. U.S.A. Hawaiian Islands. Kaua'i. **Hanalei:** rear of Waipā, *Hume & Flynn 366* (F, PTBG); Hanakāpī'ai, *St. John et al. 10913* (BISH, W); Limahuli V., *Wichman 200* (PTBG). **Kawaihau:** Anahola, *Degener & Ordonez 12831* (A, NY); ridge behind Pāpa'a, *Degener & Greenwell 21736* (B, BISH). **Līhu'e:** Kīpū, Hā'upu, *St. John & Fosberg 13654* (BISH, BM, K, POM). **Koloa:** Kalualea, *Degener & Ordonez 12832* (F); ridge ESE of Pu'u Kolo, *Flynn et al. 3143* (PTBG), *Flynn et al. 3150* (F, PTBG); jeep trail to Wahiawa Bog, *Herbst 2095* (BISH, PTBG); ridge ESE of Pu'u Kolo, *Lorence & Flynn 6284* (MO, PTBG); road to Wahiawa Bog, *Stern & Carlquist 1338* (RSA, US); Lā'aukahi, *St. John & Fosberg 13455* (BISH); peak ½ mi. N of Lā'aukahi, *St. John et al. 22990* (BISH, NY [seed voucher]); ¾ mi. N of Lā'aukahi, *St. John et al. 23026* (BISH); N of Wahiawa Bog, *St. John & Ehrendorfer 26767* (BISH).

Cyanea minutiflora Lammers, sp. nov. TYPE: U.S.A. Hawaiian Islands: Kaua'i, mts. near Ka Loko Reservoir (Kilauea), 10 Oct. 1916, *C. N. Forbes 568.K* (holotype, BISH; isotypes, BISH, MO, RSA). Figure 4C.

Haec species a speciebus omnis aliis *Cyaneae* corolla minimis 15–16.5 mm longa differt.

Stems 0.8–0.9 cm diam. near apex, glabrous; pith chambered. Lamina oblong, 12.5–17 × 3.5–4.2 cm; upper surface green, glabrous; lower surface light green, glabrous; margin callose-crenulate; apex acuminate or cuspidate; base obtuse; petiole 5–10 cm long, 1.7–2 mm diam., ⅖–⅔ as long as the lamina, glabrous. Racemes 30- to 40-flowered over their life, but only a few open at any one time; peduncle ascending, 35–50 mm long, 1.3–1.7 mm diam., glabrous; rachis 12–25 mm long, glabrous; bracts triangular, 1 × 0.5 mm, subtending the pedicels, deciduous, pubescent, acuminate at apex; pedicels ascending, 5–11 mm long, 0.3–0.5 mm diam., bibracteolate at about the middle, glabrous; bracteoles linear, 0.4–0.6 × 0.1–0.2 mm, acuminate at apex. Hypanthium globose or broadly elliptic, 2.3–2.7 mm long, 2.8–3 mm diam., ⅐–⅙ as long as the corolla, glabrous; calyx lobes triangular or deltate, 0.3–0.4 × 0.3–0.4 mm, pubescent, acuminate at apex; corolla 15–16.5 mm long, glabrous; corolla tube gently curved, 9–10 mm long, 2.4–2.5 mm diam. at base, gradually narrowing to 1.2–1.4 mm diam. at middle, then increasing to 2.2–2.8 mm diam. at mouth; dorsal corolla lobes linear triangular, 6–7.5 × 0.8–1 mm, ⅗–⅘ as long as the tube, acuminate at apex; ventral corolla lobes narrowly triangular, 5–6 × 1–1.2 mm, acuminate at apex; staminal column slightly exserted, emerging from the corolla between the dorsal lobes; filament tube slightly decurved, 12–14 mm long, 0.4–0.7 mm diam., glabrous; anther tube slightly decurved 1.5–1.8 mm diam., the surfaces glabrous; dorsal anthers 4.5–5 mm long, ⅓–⅖ as long as the filaments; ven-

tral anthers 3–3.5 mm long, with tufts of hairs 0.9–1.1 mm long at apex. Mature fruit and seeds not seen.

Distribution, habitat, and phenology. Endemic to northeastern Kaua'i in the Hawaiian Islands, and known only from the type. Flowering in October.

Etymology. The specific epithet refers to the small flowers, the smallest known in the genus; a compound adjective, from Latin *minutus*, very small, and *flos*, flower.

Relationships. As noted above, a single specimen previously identified as *C. fauriei* differs from *C. pseudofauriei* in a number of features. This plant had oblong laminas (vs. narrowly elliptic or oblanceolate) acuminate or cuspidate at apex (vs. obtuse or acute); peduncles that are thicker (1.3–1.7 vs. 0.8–1.2 mm diam.) and ascending (vs. often decurved); smaller hypanthium (2.3–2.7 vs. 3–5 mm long, 2.8–3 vs. 3–4.7 mm diam.); shorter corolla (15–16.5 vs. 25–31 mm); shorter filament tube (12–14 vs. 18–21 mm); and shorter anthers (dorsal, 4.5–5 vs. 7–8 mm; ventral, 3–3.5 vs. 5–6.5 mm). It is these floral measurements that are especially significant, as this plant has by far the smallest flowers in the entire genus. In only two other species do the flowers even begin to approach the diminutiveness of *C. minutiflora: C. elliptica* (Rock) Lammers and *C. kahiliensis* (H. St. John) Lammers.

Cyanea elliptica occurs on Maui, Lāna'i, and Moloka'i, geologically younger islands well east of Kaua'i. It differs from *C. minutiflora* by the obtuse or acute apex of the lamina; fewer-flowered racemes (6 to 14 vs. 30 to 40 flowers each); shorter peduncles (10–35 vs. 35–50 mm); more basally inserted bracteoles (at a point ⅛–⅓ the distance from the base vs. at the middle); longer corolla (17–29 vs. 15–16.5 mm); and a longer filament tube (16–18 vs. 12–14 mm).

Cyanea kahiliensis (H. St. John) Lammers is endemic to southern and eastern Kaua'i, south of the only known locality of *C. minutiflora*. It differs from *C. minutiflora* by its laminas narrowly elliptic or narrowly oblong (vs. oblong) and cuneate at base (vs. obtuse); more slender petioles (1–1.7 vs. 1.7–2 mm diam.); fewer-flowered racemes (8 to 10 vs. 30 to 40 flowers each), larger hypanthium (4–5 vs. 2.3–2.7 mm long, 3–4 vs. 2.8–3 mm diam.), longer corolla (19–25 vs. 15–16.5 mm); and longer anthers (dorsal, 5.2–6 vs. 4.5–5 mm; ventral, 4.3–4.8 vs. 3–3.5 mm).

The following key may be used to distinguish the 15 species now assigned to *Cyanea* sect. *Delisseoideae*, including *C. minutiflora* and *C. pseudofauriei*. It cannot be inserted smoothly into the existing key for the genus (Lammers, 1990a), because *C. asarifolia* and *C. linearifolia* key out there in couplets 8 and 9 (p. 440), respectively, while the remaining species appear in couplets 26–32 (pp. 441–442).

KEY TO THE SPECIES OF HAWAIIAN *CYANEA* SECT. *DELISSEOIDEAE*

1a. Lamina less than 3 times longer than wide, cordate or subcordate at base; petiole 1 ¼–2 ¼ times as long as the lamina.
  2a. Margin of the lamina callose-serrulate; inflorescences 8- to 11-flowered; peduncle 40–45 mm long; rachis 20–27 mm long; bracts 5–7 mm long; bracteoles 7.5–8 mm long, at or near the middle of the pedicel (Kaua'i) . . . . . *C. dolichopoda*
  2b. Margin of the lamina callose-crenulate; inflorescences 20- to 40-flowered; peduncle 20–35 mm long; rachis 60–70 mm long; bracts 1–1.6 mm long; bracteoles 0.9–1.2 mm long, at a point ¼–⅓ the distance from the base of the pedicel (Kaua'i) . . . . . *C. asarifolia*
1b. Lamina (2.5–)4–36 times longer than wide, attenuate, cuneate, obtuse, or rounded at base; petiole shorter than the lamina or rarely about as long.
  3a. Dorsal anthers 6.5–9.5 mm long.
    4a. Calyx lobes 3–5 × 1.7–3 mm (Moloka'i) . . . . . *C. mannii*
    4b. Calyx lobes 0.3–3.2 × 0.3–1.8 mm.
      5a. Bracts linear or linear triangular, 1.8–3.3 mm long; pedicels bibracteolate just above the base (Wai'nae Mts. of O'ahu) . . . . . *C. membranacea*
      5b. Bracts triangular, widely deltate, or deltate, 0.8–1.7 mm long; pedicels bibracteolate at a point ⅕–½ the distance above the base.
        6a. Dorsal surface of lamina, petiole, peduncle, rachis, pedicels, hypanthium, and corolla pubescent; calyx lobes 1.5–3.2 mm long; corolla 1.8–2 mm diam. at middle; ventral corolla lobes connate 9–10 mm at base (Maui) . . . . . *C. obtusa*
        6b. Dorsal surface of lamina, petiole, peduncle, rachis, pedicels, hypanthium, and corolla glabrous; calyx lobes 0.3–1.2 mm long; corolla 2–4.2 mm diam. at middle; ventral corolla lobes connate 1–5 mm at base (Kaua'i).
          7a. Stems 1.4–2.5 cm diam. near apex; lamina oblong, 5.5–11.2 cm wide *C. coriacea*
          7b. Stems 0.7–1.3 cm diam. near apex; lamina oblanceolate or narrowly elliptic, 2.5–5.5 cm wide.
            8a. Lamina cuneate at base; rachis 8–40 mm long; pedicels 9–14 mm long;

hypanthium broadly ellipsoid or hemispherical, 3–5 mm long; calyx lobes 0.3–0.8 × 0.3–0.4 mm; corolla tube 3.5–4 mm diam. at base, narrowing to 2–2.5 mm diam. at middle; filament tube 18–21 mm long . . . . . *C. pseudofauriei*

8b. Lamina attenuate at base; rachis 75–200 mm long; pedicels 13–22 mm long; hypanthium obconic or campanulate, 5–6.5 mm long; calyx lobes 1–1.2 × 0.5–1.2 mm wide; corolla tube 4.5–5.8 mm diam. at base, narrowing to 2.7–4.2 mm diam. at middle; filament tube 20–27 mm long . . . *C. hardyi*

3b. Dorsal anthers 4–6.2 mm long.

9a. Lamina linear, 0.3–1.3 cm wide, 20–36 times longer than wide (Kaua'i) . . . . . *C. linearifolia*

9b. Lamina oblong, narrowly oblong, elliptic, narrowly elliptic, lanceolate, oblanceolate, 1–11.2 cm wide, 2.5–18 times longer than wide.

10a. Corolla 15–16.5 mm long (Kaua'i) . . . . . *C. minutiflora*

10b. Corolla 17–30 mm long.

11a. Lamina elliptic or oblong, 2.5–4 times longer than wide, the base rounded or obtuse; bracts narrowly triangular or triangular, 1–2.5 mm long; bracteoles at a point ⅛–⅓ the distance above the base of the pedicel (Moloka'i, Lāna'i, Maui) . . . . . *C. elliptica*

11b. Lamina lanceolate, oblanceolate, narrowly elliptic, or narrowly oblong, 4–18 times longer than wide, the base attenuate or cuneate (rarely obtuse); bracts deltate or shallowly deltate (rarely triangular), 0.6–0.9 mm long; bracteoles at a point ⅓–½ the distance above the base of the pedicel.

12a. Pedicels 6–8 mm long; hypanthium broadly obovoid; dorsal corolla lobes 15 × 1.7 mm (Kaua'i) . . . . . *C. habenata*

12b. Pedicels 8–30 mm long; hypanthium obovoid, obconic, or hemispheric; dorsal corolla lobes 8–14 × 0.5–1.5 mm.

13a. Pith solid; leaf margin commonly revolute; bracteoles widely deltate, triangular, or narrowly triangular, 0.3–0.5 mm long; ventral anthers 3–3.5 mm long (Kaua'i) . . . . . *C. spathulata*

13b. Pith chambered, starting about 8 cm below the apex; leaf margin flat; bracteoles linear or linear triangular, 0.5–0.9 mm long; ventral anthers 4–5.7 mm long.

14a. Petiole ½ as long to about as long as the lamina; rachis 4–14 mm long; corolla tube dorsally cleft for ⅕–½ its length; ventral corolla lobes 5–8 mm long, connate basally for 2–4 mm (Kau-a'i) . . . . . *C. kahiliensis*

14b. Petiole ⅕–⅗ as long as the lamina; rachis 10–320 mm long; corolla tube dorsally cleft for ½–⅔ its length; ventral corolla lobes 8–18 mm long, connate basally for 5–12 mm (O'ahu, Lāna'i, West Maui) . . . . . *C. angustifolia*

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Miliusa tirunelvelica, a New Species of Annonaceae from the Kalakkad–Mundanthurai Tiger Reserve, Western Ghats, India

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ABSTRACT. The new species of *Miliusa tirunelvelica* (Annonaceae), collected from the Kalakkad–Mundanthurai Tiger Reserve on the Western Ghats of Tamil Nadu, is described and illustrated. It is distinguished by the pubescence on branchlets, petioles, and pedicels; by the shape of the stamen's connective and monocarp apices; and by its stipitate fruit, with the stipe to 20 mm.

Key words: Annonaceae, India, Kalakkad–Mundanthurai Tiger Reserve, *Miliusa*, Tamil Nadu, Western Ghats.

The genus *Miliusa* Leschenault, with ca. 40 species, is distributed in India, Sri Lanka, east across southern Asia in Bhutan, Bangladesh, Myanmar, Cambodia, Laos, Vietnam, Thailand, Borneo, Indonesia, as well as Australia and New Zealand (Mitra, 1993). Among these, 14 species are found in India: 6 occur in Tamil Nadu, and 5 (*Miliusa eriocarpa* Dunn, *M. indica* Leschenault, *M. montana* Gardner ex Hooker f. & Thomson, *M. nilagirica* Beddome, *M. tomestosa* (Roxburgh) Sinclair) in the Tirunelveli Hills. Recent botanical explorations (1996–2000) to the Tirunelveli Hills, in the core zone of the Kalakkad–Mundanthurai Tiger Reserve at the southern extension of the Western Ghats in the state of Tamil Nadu, India, yielded a taxon quite different from those Indian species of *Miliusa* hitherto recognized. It is described here as a new species and is named after the type locality. This area is considered one of the biodiversity hot spots in India (Nayar, 1996; Murugan et al., 2001).

Miliusa tirunelvelica C. Murugan, V. S. Manickam, V. Sundaresan & G. J. Jothi, sp. nov. TYPE: India. Tamil Nadu: Tirunelveli District, Kakachi Hills, Kakachi–Sengaltheri path, 800–1300 m, 1 Sep. 1998, *V. S. Manickam 17205* (holotype, XCH; isotypes, MH, MO, XCH). Figure 1.

Miliusae wightianae affinis, sed ramulis et petiolis pilosis (in illa glabris); pedicellis longioribus, 1.5–4 cm longis et pilosis (in illa curtioribus, 1.5–2.5 cm longis et glabris); connectivo apice hemisphaerico (in illa apiculato); carpellis paucis, ca. 20 (in illa multis); carpellis adultorum apice obtusis, (in illa apice acutis) differt.

Evergreen *small tree* 2–4 m tall; bark black, glabrous, wrinkled when dry; branchlets terete, brown pilose; internode 5–10 mm long. *Leaves* alternate, simple, elliptic to lanceolate, 4–9 × 1–2.5 cm, membranous, glabrous except midrib, base widely cuneate, margin entire, ciliate, apex caudate; secondary veins 6 to 8 pairs, slightly conspicuous below, looped at blade margins; petioles 2–3 mm long, brown pilose. *Flowers* axillary, solitary, 1–1.5 cm diam., bisexual, regular, actinomorphic; pedicels 1.5–4 cm long, slender, sparsely pilose; bracts 2 or 3, ovate, ca. 0.5 mm long, proximal above the base; *sepals* 3, elliptic to lanceolate, ca. 1.5 × 1 mm, sparsely pubescent, valvate, reflexed; *petals* 6 (3 + 3), 2 whorled, valvate; outer petals 3, sepaloid, lanceolate, as long as sepals, sparsely pubescent, alternate to sepals, reflexed; inner petals 3, alternate to outer petals, pink with white tinge, elliptic, ca. 1.5 × 0.8 cm, connivent, sparsely pubescent, rather less so within, base cuneate, apex widely acute; *stamens* ca. 30–40, 6-seriate, ca. 1.5 mm long; connectives flat, not concealing anthers, hemispherical at apex; anthers ovate, ca. 1 mm long, 2-celled; *carpels* ca. 20, free, oblong, rarely falcate, 1–1.5 mm long, pubescent at base; ovules 2, collateral; style 0; stigma terminal, obconic, ca. 1 mm long. *Monocarps* 7 to 21, oblong, 1–1.5 × 0.8–1 cm, glabrous, apex obtuse, pink; stipe 10–20 mm long, terete, glabrous; seeds ovoid, 5–8 mm diam., smooth.

Distribution. Endemic to Tirunelveli Hills; recorded so far from only four hilly tracts, viz. Papanasam, Kalakkad, Kothayar, and Mahendragiri in Western Ghats, Tamil Nadu, India; 800–1500 m elevation.

Flowering and fruiting. June to April.

Ecology. The new species is found along streams of wet evergreen forests between 900 and 1700 m. It is associated with *Acronychia pedunculata* (L.) Miquel (Rutaceae), *Aglaia simplicifolia* (Beddome) Harms (Meliaceae), *Begonia fallax* DC.

Figure 1. *Miliusa tirunelvelica* Murugan et al. —A. Twig. —B. Flower. —C. Inner petal (outer and inner surfaces). —D. Androecium. —E. Stamen. —F, G. Carpel (immature). —H. Monocarp. —I. Seed. Drawn from the type, *V. S. Manickam 17205* (XCH).

(Begoniaceae), *Cullenia exarillata* Robyns (Bombacaceae), *Elaeocarpus munronii* (Wight) Masters (Elaeocarpaceae), *Euonymus crenulatus* Wallich ex Wight & Arnott (Celastraceae), *Gomphandra coriacea* Wight (Icacinaceae), *Impatiens cordata* Wight, *I. uncinata* Wight (Balsaminaceae), *Lasianthes cinereus* Gamble (Rubiaceae), *Leea indica* (Burman f.) Merrill (Leeaceae), *Ophiorrhiza eriantha* Wight (Rubiaceae), *Orophea thomsoni* Beddome (Annonaceae), *Saprosma corymbosum* (Beddome) Beddome (Rubiaceae), *Syzygium mundagam* (Bourdillon) Chithra (Myrtaceae), and *Xanthophyllum flavescens* Roxburgh (Xanthophyllaceae).

Etymology. The species epithet refers to the type locality of this species.

Miliusa tirunelvelica C. Murugan, V. S. Manickam, V. Sundaresan & G. J. Jothi is allied to *Miliusa wightiana* Hooker f. & Thomson by its leaf shape,

flower, pedicel, and stamens. However, the new species differs by pubescence on branchlets and petioles; the pedicel length 1.5–4 cm long; the stamen connectives hemispherical at apex; the monocarps obtuse at their apex with a stipe to 10–20 mm long. The new species is often confused with *Miliusa nilagirica* and *M. wightiana* by their similar pedicel length.

Paratypes. INDIA. **Tamil Nadu:** Tirunelveli District, Papanasam Hills, Kannikatti-Peyyar, 5 June 1997, *V. S. Manickam 12887* (XCH); Kalakkad Hills, Sengaltheri, 8 Dec. 1996, *V. S. Manickam 11652* (XCH); Kakachi Hills, Kakachi–Sengaltheri path, 1 Sep. 1998, *V. S. Manickam 17197* (XCH); on way to Sengaltheri, 29 May 1999, *V. S. Manickam & C. Murugan 19304* (XCH); Kanniyakumari District, Kothayar Hills, Kothayar–Muthukuzhivayal, 11 Mar. 1998, *V. S. Manickam 14951* (XCH); Mahendragiri Hills, on way to Parvatham from Red Fort Estate, 20 Mar. 1999, *V. S. Manickam 18593* (XCH).

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Murugan, C., V. S. Manickam & V. Sundaresan. 2001. *Memecylon tirunelvelicum*, a new species of Melastomataceae from Peninsular India. Novon 11: 197–199.

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A New Species of a Peltate-Leaved *Begonia* (Begoniaceae) from Vietnam

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ABSTRACT. *Begonia phuthoensis* H. Q. Nguyen (sect. *Coelocentrum*), a new species from Phu Tho and Thanh Hoa Provinces (Vietnam), is described and illustrated for Begoniaceae. *Begonia cavaleriei* H. Léveillé (sect. *Diploclinium*), a species previously known only from China, is reported for the first time from Vietnam.

Key words: *Begonia*, Begoniaceae, section *Coelocentrum*, section *Diploclinium*, Vietnam.

The genus *Begonia* L., one of three genera in the family Begoniaceae, contains about 1400 species (Doorenbos et al., 1998; Swenson & Tebbitt, 2001; Swensen et al., 2001) of terrestrial or epipetric herbs or occasionally subshrubs or shrubs. Plants of *Begonia* are monoecious or very rarely dioecious. Begonias have unisexual or androgynous inflorescences, and inferior ovaries, with 1(to 3) or 4(to 7) often unequal wings or horns, or more rarely lacking wings. The genus is currently divided into 63 sections (Doorenbos et al., 1998) and is mainly distributed in the forests of the tropics and subtropics of South American, Africa, and Asia.

Gagnepain (1919, 1921) was the first author to describe the begonias of Vietnam. His works collectively include descriptions of 18 species that are not assigned to sections. Most recently, Vietnamese botanist Pham (1999) recognized 46 species and 1 hybrid as occurring in Vietnam. Thirty-four of these species are considered to be native. Doorenbos et al. (1998) listed 11 species as being indigenous to Vietnam. These are distributed among 8 sections. Previous studies of Vietnamese *Begonia* from Vietnam (Gagnepain, 1919, 1921; Pham, 1999) do not include any species with peltate leaves. Two such species, which belong to two different sections, are described herein: *Begonia phuthonensis* sp. nov. and *B. cavaleriei* H. Léveillé.

BEGONIA SECT. *COELOCENTRUM* IRMSCHER

Begonia phuthoensis H. Q. Nguyen, sp. nov. TYPE: Vietnam. Phu Tho Province: Thanh Son Distr., Xuan Son Mun., Xuan Son National Park, 30 Nov. 2000, shady on limestone-derived soil, 400–600 m, *V. X. Phuong, N. K. Khoi, N. Q. Binh & N. Q. Hieu: Phuong 4041* (holotype, HN; isotype, MO). Figure 1.

Haec species ad *Begoniam umbraculifoliam* maxime accedit, sed ab ea folio in sicco crasse coriaceo margine integro atque inflorescentia quam petiolo breviore distinguitur.

Acaulescent herb, 25–30 cm tall; rhizome prostrate, 5 mm diam., pubescent; stipules persistent, triangular, 5–8 mm long, glabrous except for setose apex. Leaves peltate, clustered at apex; petiole light brown, 25–30 cm long, tomentulose; blades densely hirsute when young, hairs red, mature lamina glossy above, green, 9–18 × 7–12 cm, round at base, apex shortly acuminate, adaxial surface sparsely hispidulous, abaxial surface pilose along the veins, margin sparsely ciliate, venation palmate; veins brown, 7, tertiary veins reticulate. Inflorescences arising directly from the rhizome, bisexual, protogynous, cymose, 5- to 10-flowered; peduncle slender, white-pink, 8–12 cm long; bracts persistent, deep pink, broadly ovate or obovate, 5–8 × 5–6 mm, glabrous, margins bristly. Flowers pink-white, 2–2.5 cm diam. Male flowers with pedicel 0.8–1 cm long; tepals 4, outer 2 broadly ovate, ca. 1 × 0.8 cm, upper half of tepal margin sometimes sparsely ciliate with glandular hairs abaxially; inner 2 ovate, 0.7–0.8 × ca. 0.2 cm, glabrous. Androphore absent. Stamens ca. 21, yellow; anther obovate, apex truncate, dehiscing laterally along sutures, 1–1.5 mm long; filament as long as anther. Female flowers with pedicel 1.5–1.8 cm long; tepals 3, outer 2 broadly ovate, ca. 1 × 0.8 cm, the inner 1 oblong, 0.7–0.8 × ca. 0.2 cm; ovary 1-locular, placentas 3 on the outer wall, subequally

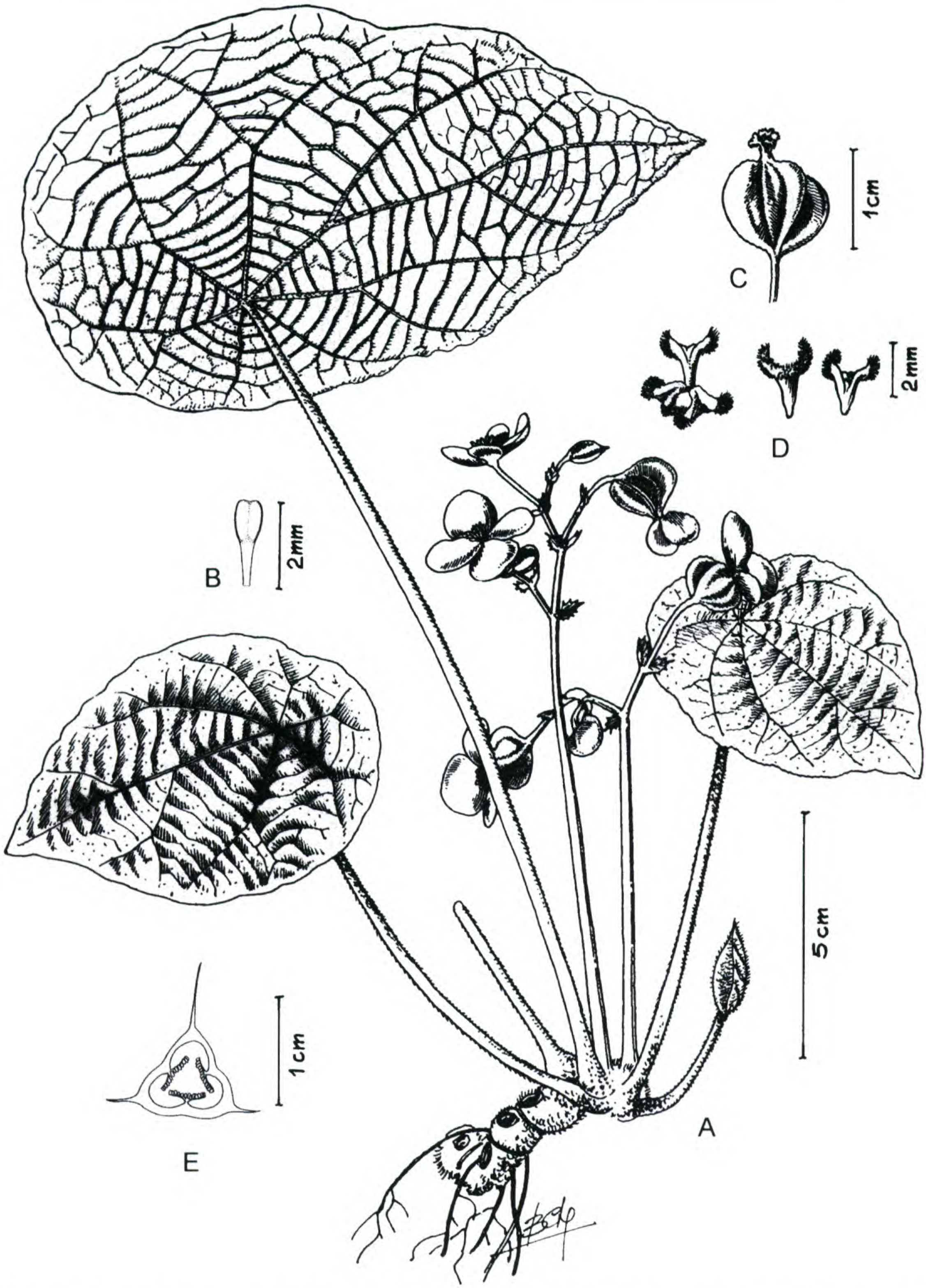

Figure 1. *Begonia phuthoensis* H. Q. Nguyen. —A. Plant. —B. Stamen. —C. Female flowers. —D. Stigmas. —E. Cross section of ovary. (Drawn from the HN holotype, *Phuong et al. 4041*.) Illustration by Bui Xuan Chuong.

bifid; styles 3, ca. 2 mm long, yellow, stigmatic lunate. Fruits white-pink, ca. 1 cm long; wings 3, subequal, rounded, 3–6 mm long, dehiscing between locule and wing; seeds barrel-shaped, pale brown, ca. 0.5 mm long.

Distribution. Endemic to southern Vietnam, with a wide distribution in provinces Phu Tho (Thanh Son District) and Thanh Hoa (Ba Thuoc District).

Begonia sect. *Coelocentrum* Irmscher, to which *Begonia phuthoensis* belongs, contains about 18 species (Doorenbos et al., 1998; Shui et al., 2002), of which only 2 Chinese species, *B. setuloso-peltata* C. Y. Wu and *B. umbraculifolia* Y. Wan & B. N. Chang, have peltate leaves (Ku, 1999; Wan & Chang, 1987). The other Vietnamese begonia in this section, *B. portei* H. Léveillé, does not have peltate leaves. One locule, the main character of the section *Coelocentrum*, distinguishes it from other sections. *Begonia phuthoensis* most closely resembles *B. umbraculifolia* in having leaves with shortly acuminate apices, six or seven palmate veins, and reticulate tertiary veins. The new species differs by its thicker, bullate leaves that lack white spotting, and by its sparsely ciliate margins, densely pilose abaxial veins, and a glabrous peduncle that is shorter than the petiole. By contrast, *B. umbraculifolia* has thin, non-bullate leaves that are white spotted and have irregularly dentate and ciliate margins, sparsely strigose abaxial veins, and a pubescent peduncle that is longer than the petiole.

Paratypes. VIETNAM. **Thanh Hoa Prov.:** Ba Thuoc Distr., Co Lung mun., 17 Apr. 2001, *N. T. Hiep, L. Averyanov & P. K. Loc: HAL 1094* (HAST, HN, MO, LE).

Begonia sect. *Diploclinium* (Lindley) A. DC.

Begonia cavaleriei H. Léveillé, Repert. Sp. Nov. 7: 20. 1909. TYPE: *Dushan s.n.* (holotype, KUN not seen).

This is the first record of *Begonia cavaleriei* from Vietnam. The species was previously known to be endemic to China (Ku, 1999). Section *Diploclinium*, to which *B. cavaleriei* belongs, includes 52 species (Doorenbos et al., 1998), of which only the Chinese endemic *B. josephii* A. DC., *B. peltatifolia* H. L. Li, *B. wangii* Yu, and *B. cavaleriei* have peltate leaves.

Distribution. Vietnam (Ha Giang, Son La, Thanh Hoa Provinces); China.

Habitat. The region of northern Vietnam (Ha Giang Prov.: Quan Ba Distr.) where *Begonia cavaleriei* grows is characterized by extensive ancient, solid marble-like and highly eroded limestone ridges. This begonia grows on damp limestone rocks under a shady, mixed evergreen-deciduous forest canopy, as well as in degraded agricultural fields among limestone rocks and on ridges of exposed limestone under light canopy with many epiphytes and lithophytes.

Specimens examined. VIETNAM. **Ha Giang Prov.:** Quan Ba Distr., Can Ty Mun., *D. K. Harder, N. T. Hiep, L. Averyanov, N. Q. Hieu & K. Daria: DKH 4796* (HN, LE, MO); Yen Minh Distr., Lao Va Chai Mun., *N. T. Hiep: NTH 3451* (HN, LE, MO). **Son La Prov.:** Yen Chau Distr., Muong Lum Mun., *D. K. Harder, N. T. Hiep, P. K. Loc, D. Stone, P. Manos & A. L. Thomas: DKH 576* (HN, LE, MO); Moc Chau Distr., Cho Long, *Vu Xuan Phuong 79* (HN). **Thanh Hoa Prov.:** Ba Thuoc Distr., Co Lung Mun., *N. T. Hiep, L. Averyanov & P. K. Loc: HAL 948* (HN, LE, MO).

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A New Species of *Ceratolacis* (Podostemaceae) from Minas Gerais, Brazil

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ABSTRACT. A new species of *Ceratolacis* (*C. pedunculatum*, Podostemaceae) is illustrated and described. The new species is known from four locations in central Minas Gerais, Brazil. *Ceratolacis pedunculatum* is distinguished from the only other species of the genus based on the presence of a prominent peduncle and the oblique orientation of the ovary on the pedicel.

RESUMO. Uma nova espécie de *Ceratolacis* (*C. pedunculatum*, Podostemaceae) é descrita e ilustrada. Esta espécie nova é conhecida de quatro localidades no centro de Minas Gerais, Brasil. *Ceratolacis pedunculatum* se distingue da outra espécie do gênero conhecida, pela presença de um pedúnculo proeminente e a orientação oblíqua do ovario sobre o pedicelo.

Key words: Brazil, *Ceratolacis*, Podostemaceae.

Prior to this current report *Ceratolacis* was a monotypic genus (*C. erythrolichen* (Tulasne & Weddell) Weddell). *Ceratolacis erythrolichen* is based on the basionym *Dicraea erythrolichen* Tulasne & Weddell of Tulasne (1849: 102). In his description of *D. erythrolichen*, Tulasne (1849) placed the species in his section *Ceratolacis*. In 1873, Weddell (1873: 66) elevated section *Ceratolacis* to the genus level: *Ceratolacis* Weddell.

While conducting field studies in Minas Gerais, Brazil, the authors collected material that represents a new species. Phylogenetic analyses based on morphological characteristics (Philbrick, Novelo, Rutishauser & Les, unpublished) indicated that the new species was monophyletic with *Ceratolacis erythrolichen*. Thus, the new species was placed in the genus *Ceratolacis*.

Ceratolacis pedunculatum C. T. Philbrick, Novelo & Irgang, sp. nov. TYPE: Brazil. Minas Gerais: ca. 16 km SW of Pompeú, along BR-262 on road to Martinhos Campos, rio Pará, 19°16′36.9″S, 45°07′54.2″W, 598 m, 16 July 2001, *C. T. Philbrick, A. Novelo R., B. E. Irgang & C. V. de Senna Gastal 5679* (holotype, BHCB; isotypes, ICN, MEXU, MO, NY, WCSU). Figure 1.

Herba aquatica. Radices virides, elongatae et cylindricae ubi juvenes, ubi vetustiores latae thalloidesque. Folia petiolata, disticha, stipulata, ditheca, erecta, 1–6 plo divisa, raro subdichotoma vel pinnata; stipulae asymmetricae, ex folii base amplexicauli cymbiformi constatae. Inflorescentia uniflora, pedunculata. Flores solitarii in axillis foliaribus. Spathella claviformis. Pedunculus et pedicellus post spathellae rupturam elongantes. Tepala 3, uno in andropodii quoque latere, tertio tepalo ad andropodii apicem portato. Stamina 2. Andropodium et filamenta per anthesin elongantia. Pollinis grana in dyadibus. Ovarium ex 2 carpellis aequalibus compositum, 2-loculare, in pedicello oblique dispositum. Stigmata 2, libera, stigmatum base in fructu indurata, persistenti. Fructus capsularis, 2-locularis, apice emarginato, duabus valvis aequalibus, persistentibus, 3-costatis, marginibus suturalibus incrassatis. Pedunculus a pedicello in fructu non distinguibilis.

Aquatic herbs, perennial. Roots green, elongate and cylindrical when young, becoming broad and crust-like, irregular in outline when older, branched, prostrate, flattened to elliptical in cross section, median = 0.9 (0.3–5.2) mm [N = 50] wide, tightly attached to rocks via adhesive hairs, growing intertwined. Stems monomorphic, arising opposite or subopposite along the flanks of roots, 4.9 (0.9–

12) mm [N = 50] apart, obscured by leaf bases, erect, less than 0.1 mm high, unbranched. Leaves petiolate, distichous, stipulate, double-sheathed, upright, compound, 4 (1–6) [N = 50] times divided, rarely subdichotomous or pinnate, 17 (2.9–35.2) mm [N = 100] long, ultimate leaf segments linear to spatulate, 3.1 (0.2–9.5) mm [N = 100] long × 0.3 (0.1–1) mm [N = 100] wide, midvein faint or lacking, apices acute or obtuse; petiole 3.9 (0.4–14) mm [N = 100] long, elliptical in cross section; stipules asymmetric, composed of an extension of the amplexicaul leaf base, 0.5 (0.1–5.6) mm [N = 50] long, larger on leaves subtending flowers, apex entire. Inflorescence with flowers pedunculate and solitary. Flowers 2 (1–6) [N = 50] per stem, hermaphroditic, zygomorphic, borne singly in a leaf axil, covered by a spathella, pedicellate; peduncle (below attachment point of spathella) 0.8 (0.1–3.1) mm [N = 100] long prior to spathella rupture, elongating to 2.6 (0.3–8.5) mm [N = 100] long after spathella rupture; spathella clavate, 2.4 (1–4.5) mm [N = 100] long × 1.1 (0.6–1.7) mm [N = 100] wide, rupturing apically, falling away completely in fruit; pedicels 0.8 (0.1–3.1) mm [N = 100] long prior to spathella rupture, elongating to 5.1 (1.8–8.5) mm [N = 50] long after spathella rupture; tepals 3, scale-like, linear, acute, two (one on either side) at the base of the stalk from which the stamens arise (andropodium), 0.6 (0.2–1.8) mm [N = 50] long; a third tepal occurring at the apex of the andropodium, andropodial tepal 0.4 (0.3–0.5) mm [N = 50] long; stamens 2, deciduous; andropodium 1 (0.6–2) mm [N = 50] long prior to spathella rupture, during anthesis elongating to 4.3 (2–7) mm [N = 50] long; filaments 0.4 (0.2–1.8) mm [N = 50] long prior to spathella rupture, during anthesis elongating to 0.9 (0.4–1.8) mm [N = 50] long; anthers quadrangular, with parallel sides, 1.1 (0.7–1.4) mm [N = 50] long, 1 (0.6–1.2) mm [N = 50] wide, dehiscing introrsely and longitudinally, inner and outer thecae of equal length; pollen in dyads, tricolpate, 35 (31–40) μm [N = 100] long, 24 (19–28) μm [N = 100] wide; ovary with 2 equal carpels, 2-locular, oval in shape, oriented obliquely on the pedicel, 1.5 (0.7–2.6) mm [N = 50] long, 1 (0.6–1.7) mm [N = 50] wide, with 6 longitudinal dark lines on the ovary wall; ovules 20 (12–32) [N = 25]; stigmas 2, free, each stigma triangular in outline, widest at base, upright prior to spathella rupture, 0.5 (0.3–1) mm [N = 50] long, during anthesis upright or divergent, elongating to 0.9 (0.4–1.1) mm [N = 50] long, base of stigmas becoming hardened and persisting in fruit. Fruit a 2-locular capsule, 1.8 (1.4–2.1) mm [N = 50] long, 1.3 (0.9–1.5) mm [N = 50] wide, capsule apex emarginate due to persistent stigma bases, with two equal valves, persistent, valves 3-ribbed, suture margins thickened and rib-like; peduncle not distinguishable from pedicel in capsule (due to shedding of spathella and parenchymatous tissues of peduncle and pedicel); length of peduncle and pedicel combined 6.8 (1.5–17) mm [N = 100] long. Mature seeds unknown.

Ceratolacis pedunculatum is known from four locations in the central part of the state of Minas Gerais, Brazil (Fig. 2), ranging from about 500 to 650 m elevation. The related *C. erythrolichen* is known only from the type collection (rio Tocantins), which is approximately 1500 km north of the locations where *C. pedunculatum* was collected. Although the type locality of *C. erythrolichen* was in the state of Goias at the time the species was described in 1849, the location is presently in the state of Tocantins.

Additional observations. Two reproductive characteristics distinguish *Ceratolacis pedunculatum* from *C. erythrolichen*. *Ceratolacis pedunculatum* possesses a peduncle (Fig. 1b, 1e, 1g, 1h), and the axis of the ovary is offset (oblique) from that of the pedicel by ca. 30–45° (Fig. 1f–h). In contrast, *C. erythrolichen* lacks a peduncle and the ovary axis is parallel to that of the pedicel.

One characteristic of the root also seems to differ between *C. erythrolichen* and *C. pedunculatum*. Tulasne (1852: 126) and Engler (1930: 52) referred to the roots of *C. erythrolichen* as being red while living and turning blackish or whitish upon drying. This character is not evident in *C. pedunculatum*, in which the roots are dark green in living and dried specimens.

Justification for recognizing *Ceratolacis pedunculatum* as distinct from *C. erythrolichen* warrants some discussion of the type material of the latter species. Tulasne (1849) based his description of *C. erythrolichen* on a collection of Weddell. As Weddell worked at Paris and his collections are housed there, it has been reported (Tulasne, 1852: 127; Van Royen, 1954: 224) that the type material of *C. erythrolichen* is deposited in P. Recently, however, the type specimen has not been located there. There is one specimen located in C that seems to be the holotype. Isotypes are located in K and M. The holotype and isotypes are comprised of only vegetative material (roots, stems, leaves). As a consequence, it has not been possible to study the reproductive structures on the type material for *C. erythrolichen*. Van Royen (1954) also noted that the type material was incomplete.

Ceratolacis erythrolichen is only known from the

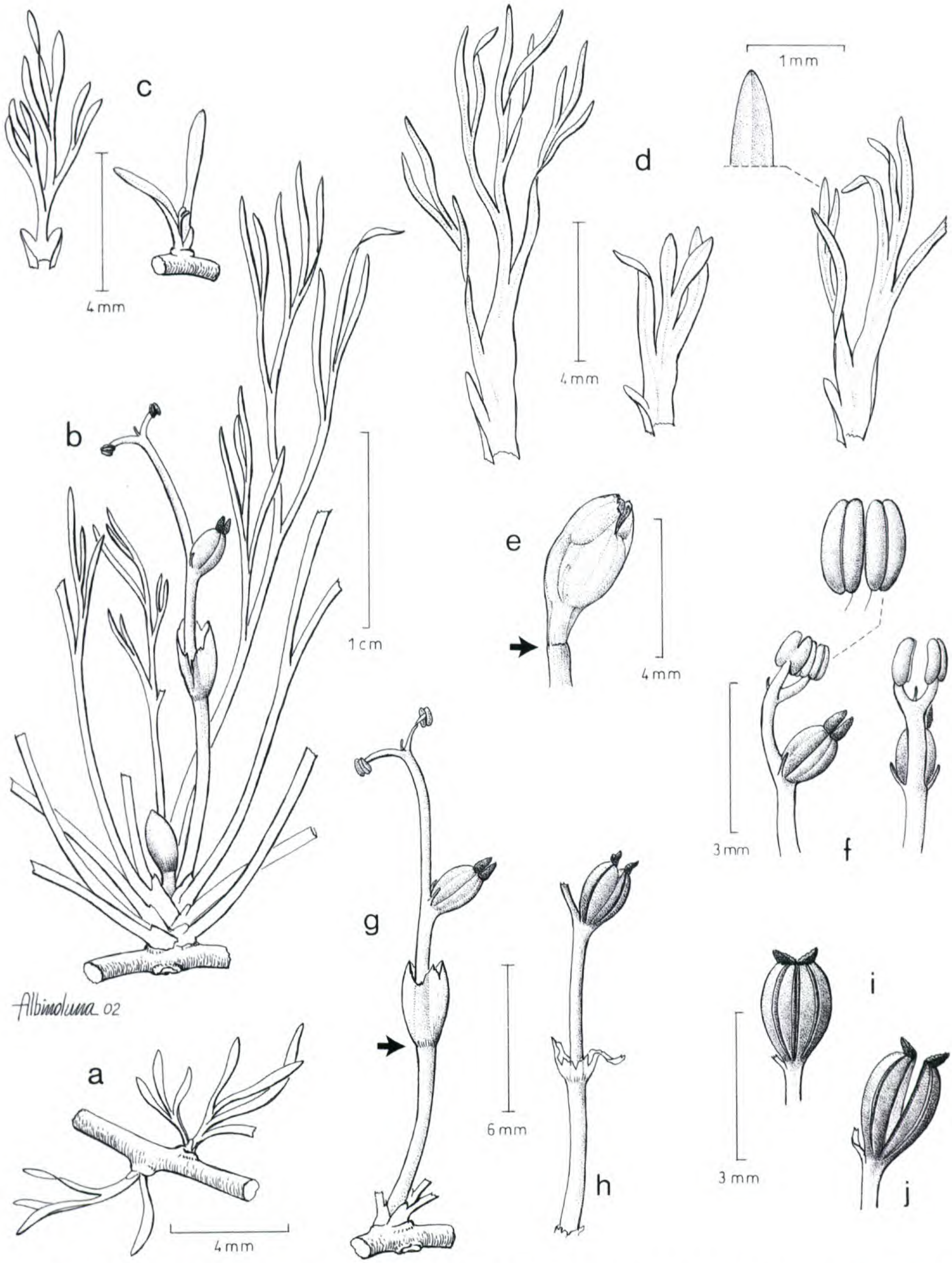

Figure 1. *Ceratolacis pedunculatum* C. T. Philbrick, Novelo & Irgang. Drawings based on the holotype. —a. General habit of plant showing cylindrical root from which leaves arise; stems are obscured by base of leaves. —b. General habit of plant showing cylindrical root, short stem (obscured by sheathing leaf bases), and two flowers—one at anthesis, the other enclosed within an intact spathella. Also showing dichotomously and subdichotomously divided leaves. —c. Details of a double-sheathed leaf with two basal stipules (left) and two simple leaves on a short stem (right). —d. Detail of three leaves showing asymmetric stipule on left side of leaf base and dichotomous to subdichotomous divisions. A detail of the apical segment of a leaf is included. —e. Flower enclosed within a spathella, which is partially ruptured at the apex. Apex of the peduncle is indicated by the arrow. —f. Two views of a flower at anthesis showing the

type collection. Thus, the present authors have had to rely on the descriptions and illustrations in Tulasne (1849, 1852, 1855) for their understanding of the reproductive morphology of the species. In the protologue for *Ceratolacis erythrolichen* (as *Dicraea erythrolichen*) Tulasne (1849: 102) did not make reference to a peduncle (a stalk below the attachment point of the spathella), nor is one indicated in the illustration for the species (his PL. X. 1). Rather, Tulasne (1849) referred only to a pedicel. (In Podostemaceae the pedicel is the stalk of the ovary that arises above the attachment point of the spathella.) Subsequently, Tulasne provided an expanded description of the species in his monograph of Podostemaceae (Tulasne, 1852: 126–128) and again in *Flora brasiliensis* (Tulasne, 1855: 253–254), but in neither case is any reference to a peduncle made. Although illustrations of the species are included in these two later works, they are the same illustrations that accompanied the 1849 description of the species. Given the prominent nature of the peduncle, the authors contended that Tulasne would have noted a peduncle if one had been present in the type material. Thus, the authors are confident that *C. erythrolichen* lacks a peduncle. *Ceratolacis pedunculatum* possesses a distinct peduncle. The peduncle occurs below the attachment of the spathella (arrows in Fig. 1e, 1g), while the pedicel occurs above. Lastly, Tulasne (1849, 1852, 1855) did not make reference to the ovary of *C. erythrolichen* being oblique on the pedicel either in his species description or in the accompanying illustrations. Based on the presence of a peduncle, the oblique orientation of the ovary, and to a lesser degree on the green roots, the authors conclude that *C. pedunculatum* is distinct from *C. erythrolichen.*

Species in three genera of Podostemaceae in the New World possess two stamens, an andropodium, and an asymmetrical sheathing leaf base (Table 1): two species of *Ceratolacis*, all species of *Crenias*, and one species of *Podostemum* (*P. muelleri* Warming). It is thus appropriate to focus on these eight species in a discussion of the characteristics of *Ceratolacis pedunculatum.*

The nature of the leaf base is partially correlated with stipule form among species of *Ceratolacis*, *Crenias*, and *Podostemum*. A single asymmetrical

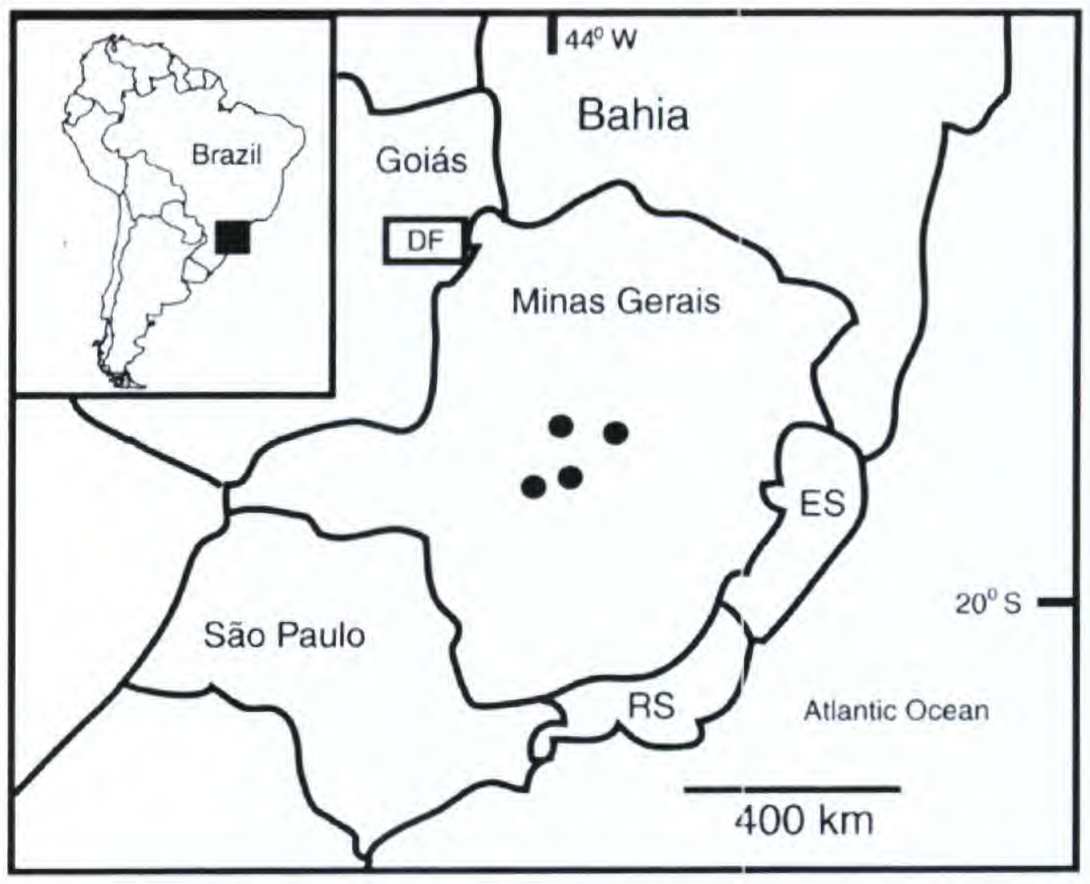

Figure 2. Distribution of *Ceratolacis pedunculatum* in the central region of the state of Minas Gerais, Brazil. DF, Distrito Federal; RS, Rio de Janeiro; ES, Espírito Santo.

stipule (a stipule on one side of the leaf base) and subdichotomous or pinnate leaves occur in species of *Ceratolacis*, *Crenias*, and one species of *Podostemum* (*P. muelleri*). In contrast, a symmetrical boat-shaped stipule (entire or divided into apical teeth) occurs in all species of *Podostemum* (except *P. muelleri* and *P. irgangii* C. T. Philbrick & Novelo); these species all have dichotomously divided leaves. *Podostemum muelleri* deviates from this correlation with its dichotomously divided leaves and asymmetrical stipule, whereas leaves of *P. irgangii* are uniformly verticillate.

Ceratolacis pedunculatum is the only New World species that has an asymmetrical stipule, an andropodium, two stamens, a pedicel, and a peduncle. The peduncle (0.1–8.5 mm long) occurs below the location where the sac-like spathella attaches to the pedicel (arrows in Fig. 1e, 1g). In contrast, the spathellas of species of *Podostemum* and *Crenias*, indeed most other species of Podostemoideae in the New World, attach at the base of the pedicel—at the point of attachment to the stem. Thus a peduncle is lacking. A peduncle is known from only three species of Podostemaceae in the New World: *Ceratolacis pedunculatum*, *Macarenia clavigera* P. Royen, and *Vanroyenella plumosa* Novelo & C. T. Philbrick.

Characteristics of the capsule distinguish species

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andropodium (stalk from which stamens arise), two anthers, two basal tepals, and one tepal arising from the apex of the andropodium. A detail of one anther is also shown. —g. A flower at anthesis showing its orientation relative to the root. Arrow indicates the apex of the peduncle. —h. A post-anthesal flower showing the remnants of the spathella arising from the apex of the peduncle. —i. Mature capsule prior to dehiscence showing the persistent and divergent stigma bases and the isolobous capsule. —j. Mature capsule after dehiscence (seeds have been dispersed) showing the two persistent capsule valves.

Table 1. Comparison of the two species of *Ceratolacis* with species of *Podostemum* and *Crenias* based on 10 selected characters.

Character	*Ceratolacis pedunculatum*	*Ceratolacis erythrolichen*	*Podostemum*	*Crenias*
Leaves	dichotomous, subdichotomous, or pinnate	dichotomous, subdichotomous, or pinnate	dichotomous or subdichotomous	subdichotomous to pinnate
Stipule	asymmetrical	asymmetrical	symmetrical or asymmetrical	asymmetrical
Peduncle and pedicel	present	absent	absent	absent
Capsule apex	emarginate	emarginate	rounded	rounded
Post-anthesal stigma base	bases persistent, divergent	bases persistent, divergent	deciduous	deciduous
Capsule valves	persistent	persistent	one valve deciduous	one valve deciduous
Ovary	isolobous	isolobous	anisolobous	anisolobous
Visible upright stem	obscured	obscured	present	present
Root form	cylindrical to flattened	cylindrical to flattened	cylindrical	cylindrical
Ovary orientation	oblique	upright	oblique	oblique

of *Ceratolacis* from *Crenias* and *Podostemum*. The capsule in the latter two genera is cylindrical in cross section, with a rounded or blunt apex. In contrast, the capsule of *Ceratolacis* is somewhat flattened with an emarginate apex, a character that is largely a consequence of the persistent stigma bases. The stigma bases are deciduous in species of *Crenias* and *Podostemum*. In addition, species in these two genera possess capsules in which one valve is deciduous, the other persists. In contrast, both valves of the capsule of species of *Ceratolacis* persist. Thus, with capsules alone it is possible to distinguish plants of the genus *Ceratolacis* from those of other genera of Podostemaceae.

Species of *Ceratolacis* possess an isolobous ovary, while the ovaries of species of *Crenias* and *Podostemum* are anisolobous. The presence of an anisolobous ovary is usually associated with the ovary set at an angle (oblique) on the pedicel. However, *Ceratolacis pedunculatum* is unusual in that the isolobous ovary is clearly oblique on the pedicel (Fig. 1f–h). There is no indication that *C. erythrolichen* shares this character.

Variation in stem and root form also helps distinguish species of *Ceratolacis*. Elongate stems characterize most species of *Podostemum* and *Crenias*, although stems of some species can be obscured by the sheathing leaf bases. *Ceratolacis pedunculatum* lacks an obvious upright stem; the diminutive stem is obscured among the leaf bases.

Roots of species of *Ceratolacis*, *Crenias*, and *Podostemum* are elongate and cylindrical when young. Roots of mature plants retain their cylindrical form in species of *Podostemum* and *Crenias*. In contrast, mature roots of both species of *Ceratolacis* often become broadened, irregular in outline, flattened, and can resemble a crust. These flattened roots are difficult to remove from the rocks. Thus, to document this character it is necessary to collect specimens and the rocks to which they are attached.

Species of *Crenias* and *Podostemum* possess dyad pollen. Dyad pollen also characterizes *Ceratolacis pedunculatum*. The authors predict that *C. erythrolichen* has dyad pollen as well, although the absence of adequate type material does not allow this prediction to be confirmed.

Paratypes. BRAZIL. **Minas Gerais:** on road from Diamantina (Gouveia) to Curvelo, confluence of rio Parauna and rio Cipó, 9 July 2002, *C. T. Philbrick, A. Novelo R., B. E. Irgang & C. V. de Senna Gastal 5649* (BHCB, ICN, MEXU, MO, WCSU); ca. 10 km W of Sao Sebastião, Route BR-420, on road to Pompéu, 9 July 2001, *C. T. Philbrick, A. Novelo R., B. E. Irgang & C. V. de Senna Gastal 5651* (BHCB, ICN, MEXU, MO, WCSU); ca. 16 km SW of Pompeú, along BR-262 on road to Martinhos Campos, rio Pará, 16 July 2001, *C. T. Philbrick, A. Novelo*

R., B. E. Irgang & C. V. de Senna Gastal 5678 (BHCB, ICN, MEXU, MO, NY, WCSU); 2 Aug. 2002, *C. T. Philbrick & A. Novelo R. 5781* (BHCB, ICN, MEXU, MO, NY, WCSU); 30 km N of Corinto on BR-496, ca. 200 m upstream of bridge, rio Bicudo, 28 July 2002, *C. T. Philbrick & A. Novelo R. 5761* (BHCB, ICN, MEXU, MO, NY, WCSU).

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Validation of *Ardisia* Section *Auriculardisia* (Myrsinaceae)

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ABSTRACT. In the recent revision of *Ardisia* subg. *Auriculardisia*, the new status, combination, and basionym for *Ardisia* sect. *Auriculardisia* were erroneously omitted. The section is validated here.

Key words: *Ardisia* sect. *Auriculardisia*, Myrsinaceae.

Because the differences used by Lundell (1981) to separate his segregate genus *Auriculardisia* from *Ardisia* were found to be unreliable, we included *Auriculardisia* within the genus *Ardisia* and revised its taxonomy. However, in our recent revision of *Ardisia* subg. *Auriculardisia* (Ricketson & Pipoly, 2003: 203), the new status, combination, and its basionym for *Ardisia* sect. *Auriculardisia* were erroneously omitted. That error is here corrected:

Ardisia sect. **Auriculardisia** (Lundell) Ricketson & Pipoly, comb. et stat. nov. Basionym: *Auriculardisia* Lundell, Phytologia 49: 341. 1981. TYPE: *Ardisia glomerata* Lundell.

Literature Cited

Lundell, C. L. 1981. Neotropical Myrsinaceae—IV. Phytologia 49: 341–354.

Ricketson, J. M. & J. J. Pipoly III. 2003. Revision of *Ardisia* subgenus *Auriculardisia* (Myrsinaceae). Ann. Missouri Bot. Gard. 90: 179–317.

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Reinstatement of *Bonellia* (Theophrastaceae)

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ABSTRACT. Following the results of a recent phylogenetic study showing that the genus *Jacquinia* is paraphyletic, the following new combinations in the genus *Bonellia* are made (all by Ståhl & Källersjö): *B. albiflora* (Lundell), *B. brevifolia* (Urban), *B. flammea* (Millspaugh ex Mez), *B. frutescens* (Miller), *B. lippoldii* (Lepper), *B. longifolia* (Standley), *B. loeflingii* (Carrasquel), *B. macrocarpa* (Cavanilles), *B. macrocarpa* (Cavanilles) Ståhl & Källersjö subsp. *pungens* (A. Gray), *B. macrocarpa* (Cavanilles) Ståhl & Källersjö subsp. *panamensis* (Lundell), *B. montana* (Ståhl), *B. mucronata* (Roemer & Schultes), *B. nervosa* (Presl), *B. nitida* (Ståhl), *B. paludicula* (Standley), *B. pringlei* (Bartlett), *B. pauciflora* (Ståhl & F. Axelrod), *B. shaferi* (Urban), *B. seleriana* (Urban & Loesner ex Mez), *B. sprucei* (Mez), *B. stenophylla* (Urban), and *B. umbellata* (A. DC.). The genus *Bonellia* is distinguished from *Jacquinia* s. str. by its mostly orange flowers and alternate leaves, flattened seeds that are incompletely covered by placental tissue, and two-layered testa. A key to the genera of the Theophrastaceae is presented.

Key words: *Bonellia,* Theophrastaceae.

The Theophrastaceae form a small Neotropical family of about 100 species of shrubs and small trees. Recent phylogenetic research (Källersjö et al., 2000) has shown that *Samolus* L., a genus traditionally included in the Primulaceae, is sister group to the Theophrastaceae and therefore should be included within the latter family or recognized as a separate family.

The Theophrastaceae s. str. (excluding *Samolus*) were monographed by Mez (1903), who recognized four genera based mainly on floral morphology, viz. *Clavija, Jacquinia, Deherainia,* and *Theophrasta.* Votsch (1904), in a leaf anatomical work, transferred one of the species of *Deherainia* to a new genus, *Neomezia,* and during more recent taxonomic work (Ståhl, 1993), the genus *Votschia* was established to accommodate a species previously included in *Jacquinia.*

Following a new analysis based on a combination of morphological and cpDNA data (Källersjö & Ståhl, 2003), it has become clear that the genus *Jacquinia* is not monophyletic and has to be divided into two genera. According to that analysis, *Jacquinia* s. str. should include species with pseudoverticillate leaves lacking or with a poorly developed mucro, lepidote young shoots, whitish flowers, globose seeds completely immersed in placental tissue, and sunken abaxial foliar sclerenchyma. This circumscription makes *Jacquinia* a chiefly Caribbean genus of 13 species. Only one of these species, *J. armillaris* Jacquin, occurs outside of the Caribbean islands, in northern coastal South America and eastern coastal Brazil (Ståhl, 1992, 1995). *Jacquinia arborea* Vahl, with a wide Caribbean distribution, has also been reported a few times from Mesoamerica, but then only from islands off the eastern coast of Mexico and Honduras.

The reinstated genus *Bonellia* is defined by alternate leaves with a well-developed mucro, glabrous or puberulous young shoots, mostly orange flowers, flattened seeds only partly immersed into placental tissue, and abaxial foliar sclerenchyma located adjacent to the lower epidermis. Two species, *B. longifolia* and *B. paludicola,* deviate by having whitish flowers, and it is therefore interesting to note that both appear at the base of the *Bonellia* clade in the phylogeny proposed by Källersjö and Ståhl (2003). Of these, *B. paludicola* is the most problematical species since it, like most members of *Jacquinia* s. str. (except *J. keyensis* Mez), has pseudoverticillate leaves. It should also be noted that one additional species, *B. albiflora,* has white flowers, but that species is morphologically very similar to *B. macrocarpa,* indicating a close relationship between these two taxa.

The genus *Bonellia* consists of 22 species distributed in Mesoamerica, northern and western

South America, and the Greater Antilles. Within the genus two morphologically and geographically distinct groups can be discerned. One of these comprises the South American species *B. mucronata* (northern Peru), *B. sprucei* (Ecuador), *B. frutescens* (northern Colombia–Venezuela), *B. loeflingii* (northern Venezuela), and the Mesoamerican *B. nervosa*. All species in this group have rather large, thick-walled and opaque fruits, comparatively flexible leaves (deciduous in *B. nervosa*), and whitened young shoots. The second group consists of species from Cuba, Hispaniola, and Puerto Rico (*B. brevifolia, B. lippoldii, B. pauciflora, B. stenophylla, B. umbellata*) with small or very small spine-tipped leaves, small, thin-walled fruits, and tiny flowers. The remaining, Mesoamerican species are more difficult to define as a natural group, although some species appear to be closely related (Ståhl, 1989; Källersjö & Ståhl, 2003).

The name *Bonellia* was published by Colla (1824) in a catalog of plants from his private garden. The name was evidently proposed by C. G. L. Bertero, whose material of a plant from Santa Martha in northern Colombia was distributed under the name of *Bonellia cavanillesii* to herbaria and botanical gardens in Europe. However, since Colla (1824) cited *Jacquinia macrocarpa* Cavanilles, a different Mesoamerican species, as a synonym, the name *B. cavanillesii* has to be treated as an obligate synonym of the latter species.

The name *Bonellia* honors the Italian zoologist Franco Andrea Bonelli (1784–1830), evidently a close friend of Bertero and Colla, but whose contribution to botany is obscure.

Key to the Genera of Theophrastaceae s. str.

1a. Unbranched or sparsely branched shrubs and trees; fully developed leaves 20–120 cm long, margins often serrate or serrulate.
  2a. Corolla rotate, tube smooth on inside; staminodes ovoid-gibbous; flowers often unisexual, male or functionally male flowers with stamen filaments fused into a permanent tube; anther not or inconspicuously produced at apex; leaf margins entire, serrulate, or serrate . . . . . *Clavija* Ruiz & Pavón
2b. Corolla campanulate or bowl-shaped, irregularly puckered on inside of tube; staminodes not obovoid; flowers bisexual, stamen filaments fused at base only; anther connective distinctly prolonged at apex; leaf margins usually spinose-dentate.
  3a. Plants erect, the stem spiny; corolla deeply campanulate, pale buff turning black upon drying; staminodes transversely oblong, inserted within the corolla tube . . . . . *Theophrasta* L.
  3b. Plants semi-decumbent, the stem not spiny; corolla bowl-shaped, orange, not blackening upon drying; staminodes triangular, minute, inserted at the mouth of the corolla tube . . . . . *Neomezia* Votsch
1b. Branched shrubs or small trees; leaves usually less than 20 cm long, margins entire.
  4a. Corolla green, > 2 cm diam. at anthesis; staminodes obtrullate to linear; fruits ovoid . . . . . *Deherainia* Decaisne
  4b. Corolla orange, whitish, or pale yellow, < 2 cm diam. at anthesis; staminodes flattened, petaloid.
    5a. Corolla bowl-shaped, pale yellow; style shorter than the ovary; foliar sclerenchyma of the lower side arranged in a continuous or subcontinuous layer . . . . . *Votschia* Ståhl
    5b. Corolla campanulate or urceolate, orange or whitish; style of the same length as the ovary; foliar sclerenchyma arranged in distinct bundles.
      6a. Young shoots ± lepidote from irregularly branched, thick-walled hairs; leaves mostly pseudoverticillate (alternate in *J. keyensis*), without or with a poorly developed apical mucro; corolla white or whitish; seeds ± globose, covered by placental tissue; abaxial foliar sclerenchyma often somewhat immersed into the mesenchyma . . . *Jacquinia* L.
      6b. Young shoots puberulous from short uniseriate hairs or glabrous; leaves alternate (pseudoverticillate in *B. paludicola*), usually distinctly mucronate; corolla orange, sometimes white or whitish; seeds flattened, incompletely covered by placental tissue; abaxial foliar sclerenchyma adjacent to lower epidermis . . . . . *Bonellia* Colla

Taxonomy and New Combinations

Bonellia Colla, Hortus Ripul. 21. 1824. TYPE: *Bonellia cavanillesii* Bertero ex Colla (≡ *Jacquinia macrocarpa* Cavanilles).

Bonellia albiflora (Lundell) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia albiflora* Lundell, Wrightia 2: 60. 1960. TYPE: Guatemala. Petén: Tikal, 29 July 1959, *Contreras 45* (holotype, LL; isotypes, S, TEX, US).

Bonellia brevifolia (Urban) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia brevifolia* Urban, Symb. Antill. 1: 379. 1899. TYPE: Cuba. Sine loco, *Wright 2913* (lectotype, designated in Ståhl (1995), GH; isotypes, G, GOET, M).

Bonellia flammea (Millspaugh ex Mez) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia flammea* Millspaugh ex Mez, Pflanzenr. IV. 236a: 40. 1903. TYPE: Mexico. Yucatán: Silam, *Gaumer 531* (lectotype, designated in Ståhl (1989), G; isotypes, A, BM, BR, C, CAS, DS, E, F, FHO, GH, K, LE, MO, NY, UPS, US, W).

Bonellia frutescens (Miller) Ståhl & Källersjö, comb. nov. Basionym: *Ruscus frutescens* Miller, Gard. Dict. ed. 8: unpaginated (species no. 8 under *Ruscus*). 1768. TYPE: Colombia. Bolívar: vic. of Cartagena, no date, *Heriberto 279* (neotype, designated in Ståhl (1995), US).

Bonellia lippoldii (Lepper) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia lippoldii* Lepper, Wiss. Z. Friedrich-Schiller-Univ. Jena, Math.-Naturwiss. Reihe 32: 876. 1983. TYPE: Cuba. Guantánamo: San Antonio del Sur, Abra de Mariana, E of Abra, 100–400 m alt., 9 Feb. 1979, *Bisse et al. s.n.* (holo- and isotype, HAJB no. 39068).

Bonellia loeflingii (Carrasquel) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia loeflingii* Carrasquel, Acta Bot. Venez. 4: 348. 1970. TYPE: Venezuela. Anzoátegui: about 10 km from Píritu on road to Clarines, Jan. 1968, *Aristeguieta et al. 6524* (holotype, VEN).

Bonellia longifolia (Standley) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia longifolia* Standley, J. Wash. Acad. Sci. 14: 241. 1924. TYPE: El Salvador. San Vicente: vic. of San Vicente, alt. 350–500 m, 2–11 Mar. 1922, *Standley 21159* (holotype, US; isotypes, F, G, GH, K, NY).

Bonellia macrocarpa (Cavanilles) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia macrocarpa* Cavanilles, Icon. 5: 55, tab. 483. 1799. TYPE: Mexico. Acapulco, Feb. 1791, *Neé s.n.* (lectotype, designated in D'Arcy (1980), B-WILLD; isotypes, HBG, MA).

Bonellia macrocarpa (Cavanilles) Ståhl & Källersjö subsp. **pungens** (A. Gray) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia pungens* A. Gray, Proc. Amer. Acad. Arts 5: 325. 1854. TYPE: Mexico. Sonora: hills between Rayón and Ures, 10 Oct. 1851, *Thurber 903* (lectotype, designated in Ståhl (1989), GH; isotypes, GH, NY).

Bonellia macrocarpa (Cavanilles) Ståhl & Källersjö subsp. **panamensis** (Lundell) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia panamensis* Lundell, in Woodson & Schery, Ann. Missouri Bot. Gard. 27: 329. 1940. TYPE: Panama. Panamá: vic. of Bejuco, 18 Oct. 1938, *Allen 985* (holotype, MICH; isotypes, GH, MO, US).

Bonellia montana (Ståhl) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia montana* Ståhl, Nordic J. Bot. 9: 27. 1989. TYPE: Nicaragua. Jinotega: Cerro de la Cruz and vic., W of Jinotega, alt. 1200–1400 m, 7 July 1947, *Standley 10968* (holotype, F).

Bonellia mucronata (Roemer & Schultes) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia mucronata* Roemer & Schultes, Syst. Veg. 4: 802. 1819. TYPE: Peru. Colasay, *Humboldt 3581* (holotype, B-WILLD, seen on microfiche; isotypes, HAL, P).

Bonellia nervosa (Presl) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia nervosa* Presl, Reliq. Haenk. 2: 67. 1835. TYPE: Mexico. Sine loco, *Haenke s.n.* (holotype, PR).

Bonellia nitida (Ståhl) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia nitida* Ståhl, Nordic J. Bot. 9: 24. 1989. TYPE: Honduras. Comayagua: vic. of Comayagua, alt. 600 m, 12–13 Mar. 1947, *Standley & Chacón 6025* (holotype, F).

Bonellia paludicula (Standley) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia paludicola* Standley, Field Mus. Nat. Hist., Bot. Ser. 11: 138. 1932. TYPE: Belize. Punta Gorda, "Forest Home," alt. 60 m, 11 Sep. 1932, *Schipp 1028* (holotype, F; isotypes, A, BM, G, GH, K, MICH, MO, NY, S).

Bonellia pauciflora (Ståhl & F. Axelrod) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia pauciflora* Ståhl & F. Axelrod, Brittonia 50: 1. 1998. TYPE: Puerto Rico. Municipio Quebradillas, Barrio Charcas, 0.7 km SSE of Charcas, 200–350 m alt., 23 June 1994, *Proctor et al. 49406* (holotype, SJ; isotypes, GB, NY).

Bonellia pringlei (Bartlett) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia pringlei* Bartlett, Proc. Amer. Acad. Arts 44: 630. 1909. TYPE: Mexico. Guerrero: Iguala Canyon, 8 Oct. 1908, *Pringle 10337* (holotype, GH; isotypes, BH, BM, C, CM, E, F, G, GOET, HBG, K, L, LE, M, MICH, MO, MSC, NY, P, PH, PR, US, VT, W).

Bonellia seleriana (Urban & Loesner ex Mez) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia seleriana* Urban & Loesner ex Mez, Pflanzenr. IV. 236a: 43. 1903. TYPE: Mexico. Oaxaca: above San Carlos Yauhtepec, 5 Jan. 1896, *Seler & Seler 1759* (lectotype, designated in Ståhl (1989), GH; isotypes, A, NY).

Bonellia shaferi (Urban) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia shaferi* Urban, Symb. Antill. 7: 320. 1912. TYPE: Cuba. Holguín: vic. of Holguín, 7 Apr. 1909, *Shafer 1231* (lectotype, designated in Ståhl (1995), NY; isotypes, A, F, GH, HAC, K, MO, US).

Bonellia sprucei (Mez) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia sprucei* Mez, Pflanzenr. IV. 236a: 43. 1903. TYPE: Ecuador. Guayas: Chanduy, *Spruce 6478* (lectotype, designated in Ståhl (1990), K; isotypes, BM, BP, CGE, G, LE, OXF, P, W).

Bonellia stenophylla (Urban) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia stenophylla* Urban, Symb. Antill. 1: 378. 1899. TYPE: Cuba. "Cuba Occ.," 1865, *Wright 2912 p.p.* (lectotype, designated in Ståhl (1995), G; isotypes, BM, GH, GOET, HAC, LE, M, NY, S, US, W). [See Ståhl (1995) for comments.]

Bonellia umbellata (A. DC.) Ståhl & Källersjö, comb. nov. Basionym: *Jacquinia umbellata* A. DC., Prodr. 8: 150. 1844. TYPE: Puerto Rico, Sine loco, *Bertero s.n.* (holotype, G-DC, seen on microfiche; isotypes, H, MEL, MO, P).

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New Taxa and Nomenclatural Notes on the Flora of the Marojejy Massif, Madagascar. VI. Rubiaceae: A New Species of *Lemyrea*

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ABSTRACT. *Lemyrea marojejyensis* J. R. Stone & A. P. Davis, a new species from the Marojejy National Park in Madagascar, is described and illustrated. The thick branchlets, large leaves, shortly pedicellate flowers, and large number of ovules (ca. 32 per locule) distinguish it from other species of *Lemyrea*. Systematic observations on the genus *Lemyrea* are provided.

Key words: *Lemyrea*, Madagascar, Marojejy, Octotropideae, Rubiaceae.

Madagascar is a country rich in endemic species and remains poorly known botanically (Morat & Lowry, 1997). In particular, the isolated massifs of northern Madagascar are extremely diverse and have yielded many new species. The broken chain of upland areas that traverses northern Madagascar contains some of the largest areas of remaining primary forest and undisturbed natural areas. While several of the larger mountains are included within protected areas, much of the area in between is unprotected and its vegetation remains threatened. This northern massif region remains poorly known botanically, but the available collections indicate that the region is home to a considerable number of endemic species. The massif at Marojejy has been one of the better collected of these isolated uplands (Humbert, 1955), yet new discoveries are still being published on a regular basis (e.g., Miller, 1998; Miller & Randrianasolo, 1998; Miller, 2000). The central portion of the Marojejy Massif and some of the surrounding lowlands comprise the 60,050-hectare protected area. Formerly known as the Réserve Intégrale No. 12, established 31 December 1927, the status of this protected area was upgraded to a National Park (Marojejy Réserve Naturelle Integrale) on 19 May 1998.

The middle elevations (ca. 600–1200 m) of the Marojejy Massif seem particularly rich and diverse in woody plant families. Araliaceae, Arecaceae, Clusiaceae, Cunoniaceae, Myrsinaceae, and Rubiaceae are particularly well represented; the herbaceous family Balsaminaceae is represented by more than 30 species (Morat & Lowry, 1997). These slopes have been the site of many newly described taxa: e.g., *Ardisia marojejyensis* J. S. Miller & Pipoly (Myrsinaceae) (Miller & Pipoly, 1993); *Sabicea marojejyensis* Razafimandimbison & J. S. Miller (Rubiaceae) (Razafimandimbison & Miller, 1999); *Rhodolaena macrocarpa* G. E. Schatz, Lowry & A. E. Wolf (Sarcolaenaceae) (Schatz et al., 2000); *Weinmannia marojejyensis* J. S. Miller & J. Bradford (Cunoniaceae) (Bradford & Miller, 2001). Recent collections from these middle-elevation parts of the reserve now yield another new species of Rubiaceae belonging to the genus *Lemyrea* (A. Chevalier) A. Chevalier & Beille.

Lemyrea marojejyensis J. R. Stone & A. P. Davis, sp. nov. TYPE: Madagascar. Prov. Antsiranana: Marojejy Réserve Naturelle Integrale, path from Mandena to summit of Marojejy, 700–1000 m, 14°26′S, 49°45′E, 2 Oct. 1994 (fl), *Lewis et al. 1249* (holotype, MO; isotypes, BR, G, WAG, K, P, TAN). Figure 1.

Arbor usque 9 m alta, ramis crassis et nodos tumidis. Folia coriacea, lamina late elliptica usque late obovata, 7.5–10 cm longa, 4–5.5 cm lata. Inflorescentiae axillares, binae, 1.9–2.2 cm longae. Pedicelli 1.5–2.4 mm longi. Corolla late infundibuliformis, carnosa, 1.3–1.5 cm longa, 5–8 mm lata. Ovarium 2-loculare, ovulis in quoque loculo circa 32.

Tree, 5–9 m tall. Branchlets terete to subquadrangular, swollen at nodes, 3.5–7 mm diam., smooth to somewhat scaly, brown to light gray or whitish. Leaves: petioles distinctly articulated at the junction with the branchlet, 0.3–1 cm long, glabrous, base adaxially canaliculate; lamina broadly elliptic to broadly obovate, 7.5–10 × (3.4–)4–5.5(–

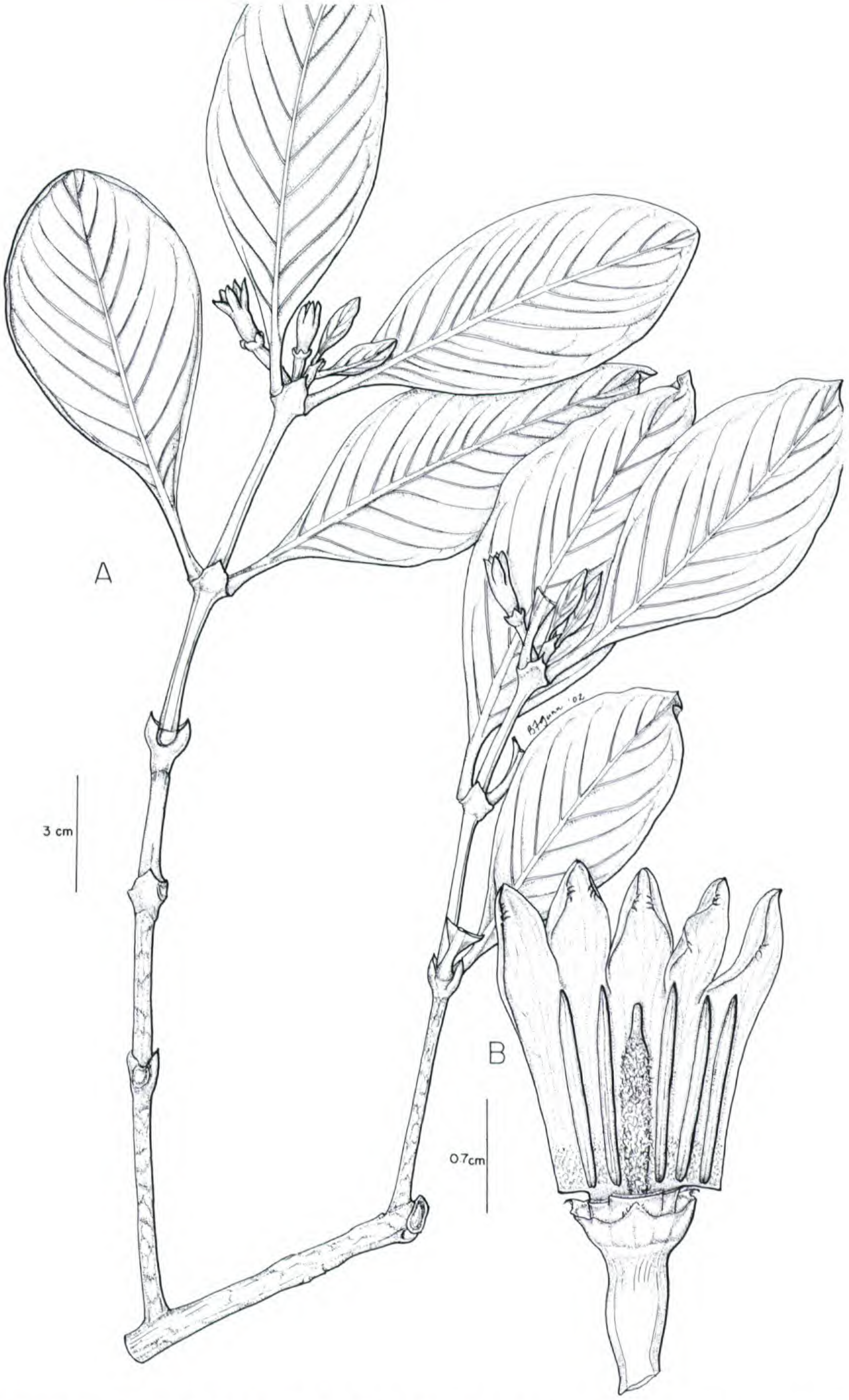

Figure 1. *Lemyrea marojejyensis* J. R. Stone & A. P. Davis. —A. Habit. —B. Flower, cut to reveal internal corolla surface, anthers, and style. Drawn from the holotype: *Lewis et al. 1249.*

6.6) cm, coriaceous; base attenuate; margin entire, subrevolute; apex acute to acuminate; midrib prominent; venation brochidodromous; secondary veins prominent on lower and upper surfaces, 11 to 15 pairs, ascending at an angle of 45°–60°, straight to slightly curved; tertiary venation obscure; adaxial and abaxial surfaces smooth, glabrous. Stipules fused, broadly triangular, 2.2–2.5 × 3.5–5.5 mm, glabrous; apex abruptly apiculate, apiculum 0.7–1.1 mm long. Inflorescences axillary in the first

node below the apex of the branchlet, paired (one inflorescence per axil), 1-flowered, 1.9–2.2 cm long. Flowers hermaphrodite, 5-merous, pedicel 1.5–2.4 mm long; calyx (incl. hypanthium) tubular, 6–7.8 mm long, texture slightly rough; calyx limb 5-lobed, sparsely ciliolate, lobes ± deltate, 0.5–0.7 × 1.2–1.6 mm, green with reddish tips; corolla broadly funnel-shaped, 1.3–1.5 cm long × 5–8 mm wide, rather fleshy, white to creamy white, the inner surface sometimes red-tinged, glabrous; corolla tube 6.5–7 × 4–5 mm; corolla lobes overlapping to the left in bud (aestivation) and usually at maturity, 5–7 × 1.5–4 mm, apices acute; stamens 5, included; anthers attached near the base of the corolla tube, sessile, elliptic to linear, 8–10 mm long; style 8–10 mm long, pubescent (trichomes white, ca. 0.2 mm long); stigma 2-lobed, lobes ca. 3 mm long. Ovary bicarpellate, with axile placentation, ovary wall glabrous; ovules ca. 32 per locule, arranged in two discrete series, white. Fruit not seen.

Distribution, habitat, and phenology. *Lemyrea marojejyensis* is known from two localities in the south-central part of Marojejy National Park in ridge-top forests between 700 and 1220 m. It has been collected in flower in October.

Conservation status. Provisional IUCN Red List Category: **Endangered** (EN B2 a b). The new species has an area of occupancy of less than 500 km^2 (10 km^2), is only known from two populations, and its continuing decline is inferred. We have given this species a provisional assessment because further field surveys in and around Marojejy National Park may determine whether additional populations exist.

Systematic notes. *Lemyrea* was established by Chevalier (1939), based on *Coffea* series *Lemyrea* A. Chevalier (Chevalier, 1938). At the present time the genus comprises three species, viz. *L. utilis* (A. Chevalier) A. Chevalier & Beille (type species), *L. ciliolata* (A. Chevalier) A. Chevalier & Beille, and *L. krugii* (A. Chevalier) A. Chevalier & Beille. Robbrecht (1980, 1988, 1994) tentatively placed *Lemyrea* in the tribe Octotropideae Beddome, although in earlier works the tribal name Hypobathreae (Miquel) Robbrecht was used (see Robbrecht et al., 1994). We confirm that *Lemyrea* is a member of the tribe Octotropideae, on the basis of its articulated petioles, entire stipules, supra-axillary inflorescences, hermaphrodite flowers, left-contorted corolla lobes, 2-locular ovary with axile placentation, pendulous ovules, and a (seed) testa with a fingerprint-like pattern.

The Octotropideae consist of ca. 30 genera, 8 of which occur in Madagascar, namely *Canephora* Jussieu, *Chapelieria* A. Richard ex DC., *Flagenium* Baillon, *Gallienia* Dubard & Dop, *Jovetia* Guédès, *Lemyrea* (A. Chevalier) A. Chevalier & Beille, *Polysphaeria* Hooker f., and *Galiniera* Delile, although the occurrence of *Galiniera* (one species: *G. myrtoides* Homolle) in Madagascar requires verification. *Canephora*, *Chapelieria*, *Flagenium*, *Gallienia*, *Jovetia*, and *Lemyrea* are endemic to Madagascar, although according to Capuron (1973 unpublished manuscript) these genera (excluding *Jovetia*) are congeneric with the Mascarene endemic *Fernelia* Commerson ex Lamarck. Schatz (2001) followed the same line of thinking and placed the above six genera as tentative synonyms of *Fernelia*. However, an ongoing study of this tribe (by A. Davis) shows that the association of these six genera with *Fernelia* is erroneous. *Fernelia* is functionally unisexual, has 4-merous flowers, and ovules attached to a septum at the apex of the ovary (i.e., in transverse section the ovary is bilocular at the apex and unilocular at the base). The Malagasy *Gallienia* shares the above characters with *Fernelia*, inferring perhaps a close relationship between these two genera, but it does not have functionally unisexual flowers. Of the other Malagasy genera it can be said that they possess sufficient clear-cut morphological differences to warrant recognition; any taxonomic decisions on their status, if required, must wait until a full survey of the tribe has been undertaken.

According to Chevalier (1939: 250) *Lemyrea* is characterized by umbellate inflorescences, nonconnate calyculi and bracts ("les bractéoles non soudées en calicules"), 5-lobed calyces with aristate lobes ("le calice à 5 dents aristées"), and campanulate corollas each with 4 or 5 lobes. His description of *Coffea* series *Lemyrea* (Chevalier, 1938) states that *Lemyrea* has two locules with one ovule in each locule, but he no doubt believed that the number of ovules per locule was the same as the number of seeds per locule. An anatomical study of *L. utilis* and *L. ciliolata* by Beille (1939) shows that the ovary is 2-locular with axile placentation, with more than four ovules per locule arranged in two series. Beille's dissections also show that there are single-celled hairs on the ovary wall of both species; *L. utilis* has more hairs on the ovary wall than *L. ciliolata*.

Examination of *Lemyrea utilis*, *L. ciliolata*, and *L. krugii* (A. P. Davis, unpublished data) shows that the genus can be characterized by: distinctly articulated petioles; sessile inflorescences (i.e., lacking a peduncle); hermaphrodite, pedicellate (4–)5-merous flowers; a calyx with cusp-like to narrowly triangular lobes; sessile, submedifixed, linear anthers; a partially (lobed) or fully divided style (lobed due

to the style being adnate for most of its length); 2-locular ovaries with axile placentation, each locule with numerous ovules per locule arranged in two series (3 to 6 per locule in *L. utilis*; ca. 8 in *L. ciliolata*; and ca. 6 in *L. krugii*); entire endosperm (i.e., non-ruminate); and testa with a delicate fingerprint-like pattern. The seeds of *Lemyrea* are imperfectly known, and so far we have only seen one fruiting specimen each of *L. utilis* (*Perrier 14175*, K) and *L. ciliolata* (*Capuron 27685-SF*, TEF). We cannot verify the observation made by Chevalier (1938, 1939) and Beille (1939) that each seed of *L. utilis* has an invagination, like the adaxial (ventral) invagination of a *Coffea* seed. Investigation of *L. utilis* (*Perrier 14175*) shows that there might be an invagination on one surface, but this could be attributed to other factors (such as a collapsed immature seed). Developing ovules of *L. utilis*, and other *Lemyrea* species, do not have an invagination; the seeds of *L. ciliolata* (*Capuron 27685-SF*, TEF) lack any sort of invagination, i.e., they are entire (A. Davis, pers. obs.). We know that the testa of all *Lemyrea* species have a delicate fingerprint-like pattern because this is visible on developing ovules; the thick, fingerprint-like testa pattern present in genera such as *Chapelieria* and *Polysphaeria* Hooker f. is visible at the ovule stage and during seed development.

Our new species of *Lemyrea*, *L. marojejyensis*, broadens the present circumscription of *Lemyrea* by having ca. 32 ovules per locule but otherwise easily falls within the circumscription of the genus. It is further distinguished from the other species of *Lemyrea* by having thick branchlets (3.5–7 mm diam.), large stipules (2.2–2.5 × 3.5–5.5 mm), large leaves (7.5–10 × (3.4–)4–5.5(–6.6) cm), and shortly pedicellate flowers (pedicel 1.5–2.4 mm long).

Paratypes. MADAGASCAR. **Prov. Antsiranana:** Marojejy Réserve Naturelle Intégrale, le long d'un affluent de la rivière Manantenina, 1220 m, 14°26′S, 49°44′E, 27 Oct. 1996 (fl), *Rakotomalaza, Messmer & Ravelonarivo 784* (K, MO).

Key to the Species of *Lemyrea*

1a. Inflorescences axillary in upper and lower leaf axils of the shoot; flowers 4-merous . . . . . *L. utilis*

1b. Inflorescences axillary in upper leaf axils of the shoot only; flowers 5-merous.

2a. Leaves usually > 4 cm wide; floral pedicel ≤ 2.4 mm long; ovules > 30 per locule . . . . . *L. marojejyensis*

2b. Leaves usually < 3.5 cm wide; floral pedicel > 5 mm long; ovules < 10 per locule.

3a. Corolla throat hairs present on almost the entire surface of the corolla tube; style glabrous, divided to the base but adnate for most of its length . . . . . *L. ciliolata*

3b. Corolla throat hairs present only at the base of the corolla tube; style pubescent, divided into two lobes but not to the base . . . . . *L. krugii*

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Resolving a Nomenclatural and Taxonomic Problem in Mexican *Oenothera* sect. *Hartmannia* (Tribe Onagreae, Onagraceae)

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ABSTRACT. Study of type material from the transvolcanic region of Mexico of two species of *Oenothera* sect. *Hartmannia* (tribe Onagreae, Onagraceae), currently known as *Oenothera deserticola* (Loesener) Munz and *O. purpusii* Munz, indicates that they represent the same species. Thus, the later name *O. purpusii* becomes a new synonym of *O. deserticola*. Also, a neotype is designated herein for *O. deserticola*. The only available name for the second species, previously incorrectly called *O. deserticola*, is *Hartmannia montana* Rose, but since *O. montana* is already occupied, a new name, *O. orizabae*, is here proposed. A previously unreported chromosome count of $n = 7$ is given for *O. deserticola*. While examining collections to resolve this problem, a series of specimens from the Sierra Madre Occidental was determined to represent a third species here described as *O. luciae-julianiae*. These three species can be distinguished by a suite of characters involving habit, petal color, and capsules. *Oenothera deserticola* is characterized by decumbent stems, morning-opening flowers, rose purple petals, and angled, but unwinged capsules with an attenuate apex, while *O. luciae-julianiae* has erect or ascending stems, evening-opening flowers, white petals, and narrowly winged capsules with an abruptly acuminate apex. *Oenothera orizabae* has decumbent stems, evening-opening flowers, white petals, and large-winged capsules with a rounded apex.

RESUMEN. El estudio de los tipos de *Oenothera deserticola* y *O. purpusii* de la sección *Oenothera* sección *Hartmannia* procedentes de la región trasvolcánica de México, indica que ambos representan la misma especie. Como resultado, *O. purpusii* es considerado sinónimo de *O. deserticola*. Una segunda especie, originalmente descrita como *Hartmannia montana*, pero cuyo epíteto específico está ocupado en *Oenothera*, es substituido por el nombre *O. orizabae*, el cual es aquí propuesto. El estudio de las colecciones procedentes de la Sierra Madre Occidental determinó que existe una tercera especie, la cual es aquí descrita como *O. luciae-julianiae*. Estas tres especies pueden ser distinguidas por una serie de caracteres relacionados al hábito, color de pétalo y de las cápsulas. *Oenothera deserticola* es caracterizada por tallos decumbentes, flores de apertura matutina, pétalos purpúreo-rosados y cápsulas angulosas, ápteras y atenuadas hacia el ápice, mientras que la especie de la Sierra Madre, aquí descrita como *O. luciae-julianiae*, tiene tallos erectos o ascendentes, flores que abren al anochecer, pétalos blancos y cápsulas estrechamente aladas con un ápice abruptamente acuminado. *Oenothera orizabae* tiene tallos decumbentes, flores que abren al anochecer, pétalos blancos y cápsulas aladas, grandes, con el ápice redondeado.

Key words: evening-primrose, Mexico, *Oenothera* sect. *Hartmannia*, Onagraceae.

Nearly one third of the 120 species of the genus *Oenothera* L. occur in Mexico. Recent focus on the phylogeny of the family Onagraceae, especially of the most diverse tribe Onagreae (Levin et al., 2003), along with analyses of biogeographic patterns of tribes Epilobieae, Gongylocarpeae, and Onagreae (Katinas et al., in press) have resulted in the need to resolve a nomenclatural problem and describe a new species.

Two relatively uncommon species from the transvolcanic region of Mexico, *Oenothera deserticola* (Loesener) Munz and *O. purpusii* Munz, have had a confused application of names since the latter was described in a revision of *Oenothera* sect. *Hartmannia* (Munz, 1932). A brief history leading up to the confusion clarifies the problem. The first species was described as *Hartmannia montana* J. N. Rose (1905). The second was published as *Xylopleurum deserticolum* Loesener (1913). Both of these species were included in Munz's revision of *Oenothera* sect. *Hartmannia* (Munz, 1932), but for some reason he was confused on the correct application of *Xylopleurum deserticolum*. Munz's description of *O. deserticola* clearly fits the taxon that J. N. Rose described as *Hartmannia montana* (1905).

It was characterized by decumbent stems, white petals, and large-winged capsules with a rounded apex. Munz cited a number of collections of it, including the type of *Hartmannia montana*, and placed Rose's name in synonymy of *O. deserticola*. Munz also cited all four syntype collections given in the original publication of *Xylopleurum desertícolum* (Loesener, 1913). It is not clear if Munz had actually seen any of the syntype collections or if he merely cited them from Loesener's protologue, while at the same time selecting one of them as the type. For reasons unknown to me, Munz was confused because at least one of the syntypes, *Seler 5614* (photo US), and likely all four judging from Loesener's description, is clearly the same taxon as the one he described in the same paper (1932) as the new species *O. purpusii* Munz. This species was characterized by decumbent stems, rose-purple petals, and smaller, angled, but unwinged capsules with an attenuate apex.

A photo of one of the four syntypes was taken before all four were destroyed in the Berlin herbarium during World War II. This photo is reproduced here in Figure 1. I had hoped to confirm the characteristics of original material of *O. deserticola* by either locating duplicates of the lectotype, other syntype collections, or photographs of any of the other three syntypes, but none were found by the collections managers who kindly searched for them at the herbaria known to have received Seler collections (A, B, CAS, F, GH, K, MEXU, NY, US). Despite not having any of Loesener's original material, it is clear from the leaves and dehisced capsule shown in the photograph that *O. deserticola* represents the same taxon that has gone under the name *O. purpusii* since 1932. The name *Oenothera deserticola* has priority over *O. purpusii*, and therefore is the correct name. This conclusion is further supported by Loesener's original description (1913), as characterized earlier.

The other species in question was first described in 1905 as *Hartmannia montana* Rose. Since the specific epithet *montana* is already occupied in *Oenothera*, a new name, *O. orizabae*, is proposed here.

During the course of study of these two species using material from a number of primarily American and Mexican herbaria, it became clear that a significant number of Mexican collections from the Sierra Madre Occidental, from Chihuahua south through Durango to Jalisco and Guanajuato that were identified as *O. deserticola* by P. H. Raven, myself, or others over the past three decades represents an undescribed species characterized by erect or ascending stems, white petals, and narrowly winged capsules with an abruptly acuminate apex. It is here described as *O. luciae-julianiae*. It has a distribution allopatric from both *O. orizabae* and *O. deserticola*. The following key distinguishes them from one another.

KEY TO SPECIES OF MEXICAN *OENOTHERA* SECT. *HARTMANNIA*

1a. Capsules winged, acuminate to rounded at apex; petals white at anthesis, fading purple.
  2a. Stems decumbent, ascending toward the apex; cauline leaf blades 1–3 cm wide, narrowly ovate, occasionally elliptic, subentire to subdenticulate; capsule body 15–26 mm long, obovoid, apex rounded, the margins winged, the wings 2.3–4 mm wide, the sterile stipe stout, 15–50 mm long; capsule body apparently dehiscing only at apex . . . *O. orizabae*
  2b. Stems erect to ascending; cauline leaf blades 0.5–1.1(–3) cm wide, elliptic to lanceolate or narrowly elliptic-ovate, denticulate to serrulate; capsule body 8–18(–25) mm long, clavate or narrowly obovoid, apex obtuse to bluntly acuminate, the wings 1.3–2 mm wide; the sterile stipe slender, 7–35 mm long; capsule body dehiscing from about half its length to nearly throughout . . . . . *O. luciae-julianiae*
1b. Capsules angled, but not winged, attenuate at apex; petals rose-purple at anthesis, fading darker . . . . . *O. deserticola*

Oenothera deserticola (Loesener) Munz, Amer. J. Bot. 19: 758. 1932. *Xylopleurum desertícolum* Loesener, Repert. Sp. Nov. 12: 238. 1913. TYPE: Mexico. Distrito Federal: Contreras, *Lyonnet 532* (neotype, designated here, MEXU-238843; isoneotypes, GH, K not seen, MEXU [3], MO, NY, US). Figure 2.

Oenothera purpusii Munz, Amer. J. Bot. 19: 759. 1932. Syn. nov. TYPE: Mexico. Ixtaccihuatl, open woods, 1903, *C. A. Purpus 1839* (holotype, POM 32827 not seen; isotypes, F, G not seen, GH, MO, NY, UC, US).

Perennial herb with usually several or sometimes more, decumbent or sometimes ascending when short, branched or occasionally simple stems 5–20(–36) cm long, usually reddish purple or occasionally pale purple, strigillose, rarely with a few longer erect hairs, often producing new rosettes via rhizomes up to 6–7 cm long, from a thick somewhat woody caudex; root fleshy and thickened in age. Rosette leaf blades 4–6 × 1–1.7 cm, oblanceolate to elliptic, sparsely to moderately strigillose, apparently quickly deciduous; petiole 0.4–1.6 cm; cauline leaf blades 1–6.5 × 0.5–1.8 cm, elliptic to elliptic-oblanceolate or narrowly so, subserrate to weakly sinuate-toothed, apex obtuse to acute, sparsely to moderately strigillose; petiole 0.1–1.1 cm long. Flowers opening near sunrise (*Iltis et al.*

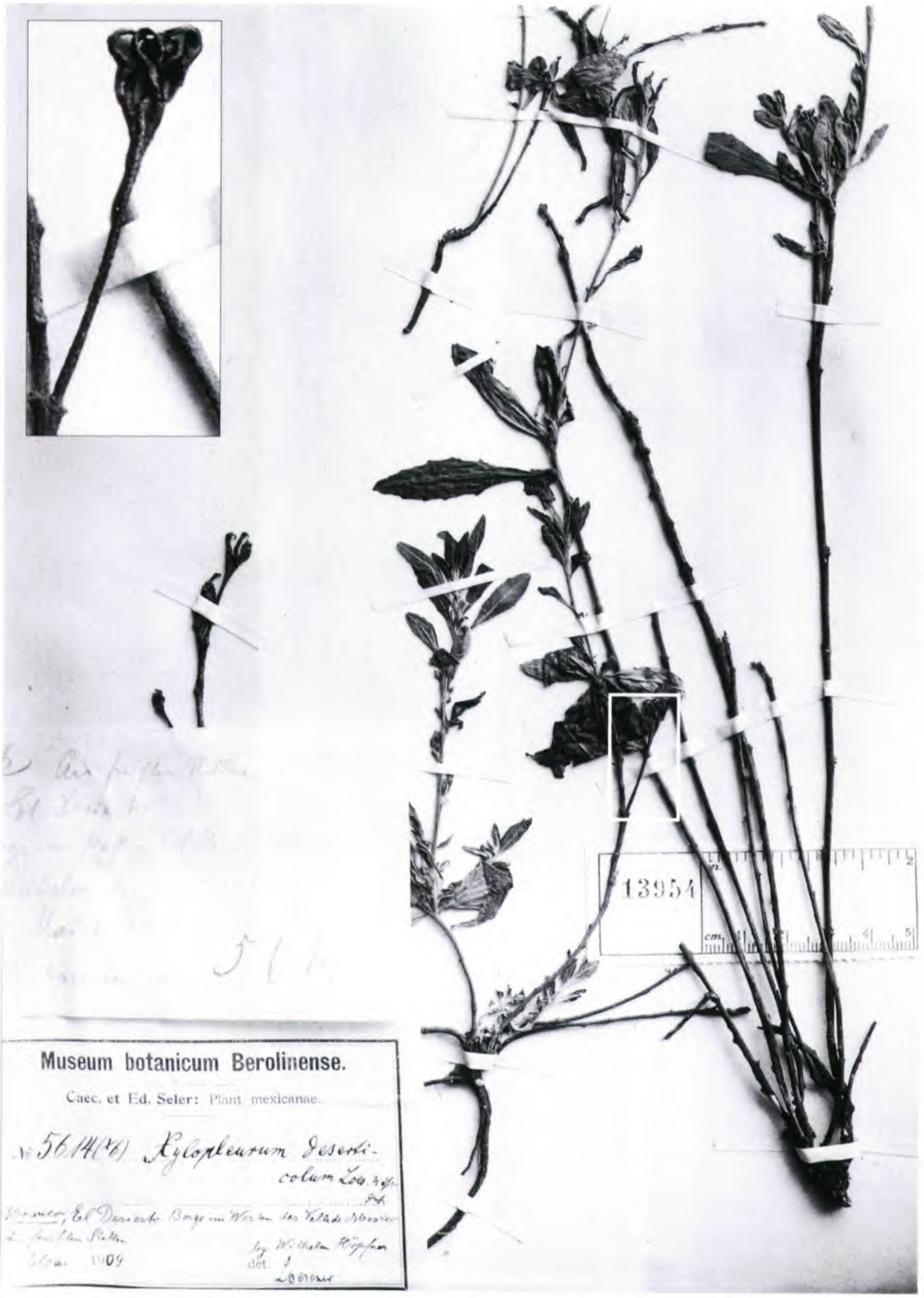

Figure 1. Reproduced photograph of *Seler 5614*, a Berlin (B) syntype of *Xylopleurum deserticolum* Loesener no longer extant, taken as part of the Field Museum's (F) Types of the Berlin Herbarium project. Copies of the photograph are in MICH, MO, NY, POM, and US. The photograph was scanned into Photoshop 6.5, and then a dehisced capsule showing the long apex of the valves allowing for unambiguous identification was cut, enlarged, and pasted into the upper left-hand corner (obscuring two small branches evident in the original). A white box on the full photograph indicates the part cut and enlarged. The leaves and part of a stem were removed from the inset for clarity.

202 says evening); floral tube, sepals, and ovary densely strigillose, and ovary usually also densely hirtellous with hairs up to 2 mm long; floral tube 4.5–11 mm long; sepals 7.5–16 mm long; free tips in bud absent or rarely present and ca. 0.1–0.2 mm long; petals 8.5–17 mm long, rose-purple fading darker after pollination; filaments 5.5–8 mm long, rose-purple; anthers 2.5–4.5 mm long, cream; pol-

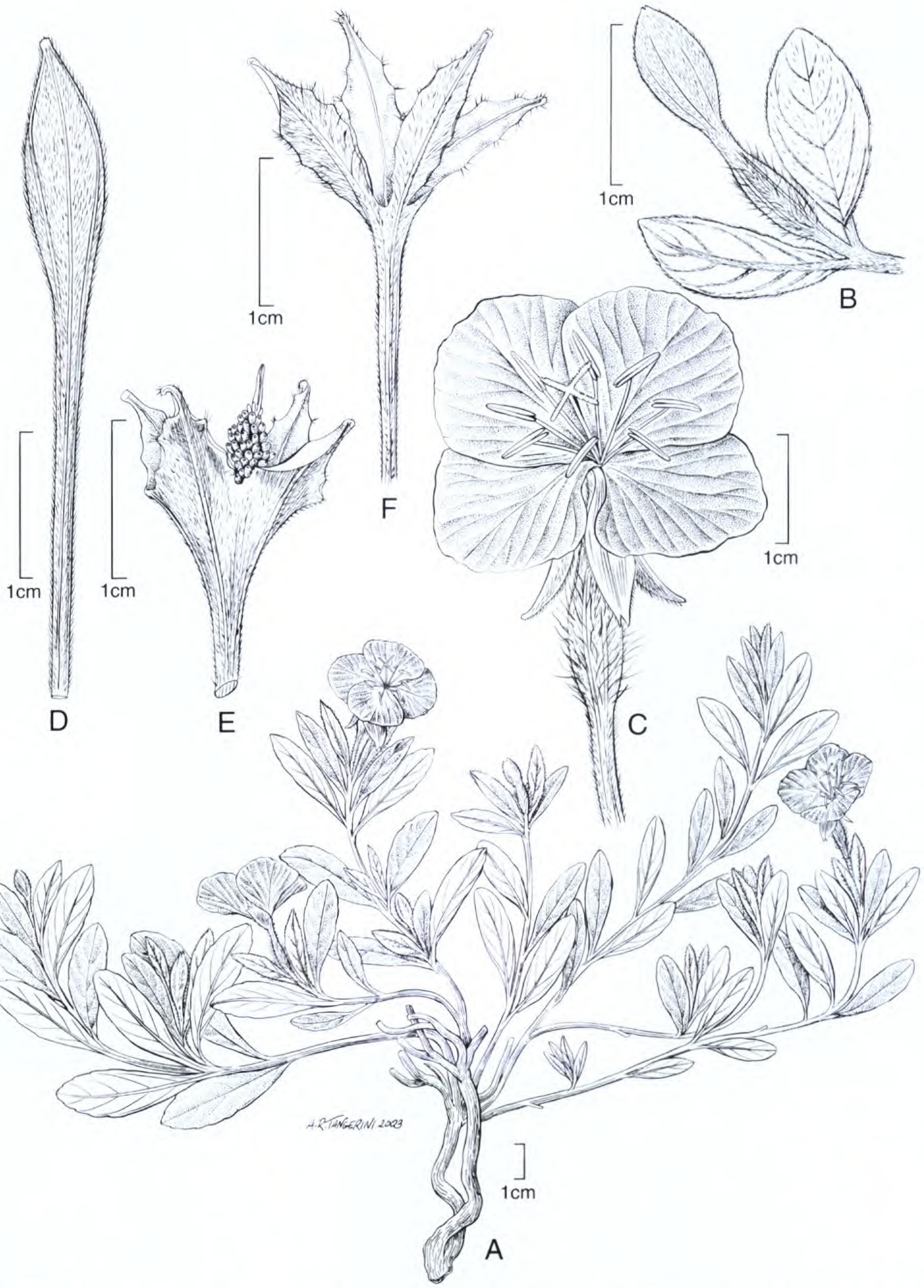

Figure 2. *Oenothera deserticola* (Loesener) Munz. —A. Habit, showing decumbent stems from a branched rhizomatous base (*Arroyo 182*, MO, and *Balogh 1005*, US). —B. Bud, floral tube, and ovary, showing the lack of free sepal tips and pubescence pattern (*Arroyo 182*, MO). —C. Flower, showing petal shape and overlap of petals (*Hinton 9104*, US). —D. Young capsule showing shape, attenuate apex, and sterile stipe (*Lyonnet 532*, MEXU). —E. Dehisced capsule showing length of dehiscence and seeds clustered on placentas (*Straw & Gregory 1116*, GH). —F. Dehisced capsule showing shape of open valves (*Lyonnet 532*, US).

len cream, > 90% fertile; style 12–21 mm long; stigma surrounded by the shedding anthers at anthesis or slightly elevated above it; stigma lobes 2.5–4 mm long. Capsule body 10–22 mm long, rose-purple to green with purple tinge, the body narrowly ellipsoid to clavate, apex attenuate, angled or rarely with a narrow wing up to 0.5 mm wide; sterile stipe slender, 7–17 mm long; capsule body

dehiscing nearly throughout; seeds clustered in each locule, 1–1.2 mm long, 0.4–0.6 mm thick, brown. Gametic chromosome number, $n = 7$ (Raven, unpublished).

Distribution. *Oenothera deserticola* occurs in open forests of *Pinus*, *Pinus-Quercus*, or occasionally *Abies*, *Alnus*, and *Salix*, on sandy open sites or steep banks, in the mountains of the Trans-Mexican Volcanic region from the northeastern Michoacán and central Hidalgo south to México and Orizaba, Veracruz, from (2100)2500 to 3400 m.

The lectotype selected by Munz (1932), but now destroyed, was collected in Mexico, D.F., El Desierto de los Leones, May 1909, *W. Höpfer s.n.* (*C. & E. Seler 5280*) (B destroyed). The lectotype and three additional syntypes (without further locality *Uhde 1222*; El Desierto de los Leones, *W. Höpfer s.n.* (labeled as *Seler 5614*) [photos: MICH, MO, NY, POM, US]; and San Rafael, Tlalmancalo, *Seler 5319*) were destroyed during World War II (Christoph Oberprieler, pers. comm. 2001).

Oenothera deserticola is a member of section *Hartmannia*, which can be subdivided into three groups of species based on petal color and time of flowering. With its rose-purple petals and morning flowering, *O. deserticola* appears to be in a group with other morning-flowering species with purple petals, including *O. platanorum* P. H. Raven & D. R. Parnell, *O. rosea* L'Héritier de Brutelle ex Aiton, and *O. texensis* P. H. Raven & D. R. Parnell. These species share angled, but not winged capsules and no free sepal tips in bud or tips free and minute (0.1–0.2 mm long).

The geographic and elevational range of *Oenothera deserticola* broadly overlaps the range of *O. orizabae*. One collection (*Barkley et al. 2438*) is a mixed collection of *O. deserticola* and *O. orizabae* suggesting that they occur sympatrically at some localities; however, there is no documentation of hybridization. Hybridization must be strongly limited by the different timing of flowering, with flowers of *O. deserticola* open during the day and those of *O. orizabae* open at night.

*Specimens examined (those marked by * are chromosome determination vouchers).* MEXICO. **Distrito Federal:** Desierto de los Leones, **Raven 15424* (also flavonoid voucher) (TEX); hwy. 190, betw. Puebla & Mexico City, *Ahshapanek 701* (TEX); Contreras Canyon, SW of Mexico City, *Munz 15000* (GH, MO); Chapultepec III, Valle del Silencio, *Wonderly 217* (MEXU, NMC); Cerro de Esquihuil, delegación de Mipa Alta, *Ventura 2804* (MEXU, MO, NY); Río Frío, *Russell & Souviron 82* (US); Volcán Pelado, ladera E, *Mondragón s.n.* (MEXU); near Estación La Cima, Serranía del Ajusco, *Rzedowski 19840* (MICH, MO, TEX); Tlalpan, Volcan Ajusco, *Reyes s.n.* (MEXU); lava fields ca. 2 km SSW of La Cima R.R. Station on either side of old Hwy. 95 on top of Serjana de Ajusco, *Iltis et al. 202* (MICH, RSA); Cerro Tepetlahualo, delegación de Milpa Alta, *Ventura 1412* (MEXU); Santa Rosa, delegación de A. Obregon, *Ventura 2720* (MEXU, MO); 1 mi. SE of Puerto del Aire, *Barkley et al. 2438* (MICH, TEX) [both sheets mixed collection with *O. orizabae*]. **Hidalgo:** Cerro de los Pitos, *Matuda 21562* (MEXU [2]); El Chico, Cerro de Las Ventanas, *Gentry et al. 32180* (MO); Parque Nacional El Chico, *Ortiz 10* (MEXU); Metzquititlan, Carpinteros, 20 km E Metzquititlan, *Hernandez 6806* (MO); Sierra de Pachuca, *Rose & Hay 5611* (US). **México:** on hwy. México to Puebla, *Munz 15064* (POM); Monte de Río Frío, km 49, road from Mexico City to Pueblo, *Mexia 2696a* (UC); near Salazar, *Rose & Painter 7027* (US); Nevada de Toluca, *Rose & Painter 7873* (US); El Crucerco, Temascaltepec, *Hinton 521* (POM); Cerro de León, Valle de Mexico, *Matuda 19128* (MEXU [2]); Paraje Provincial, *Balls 4173* (UC, US); San Rafael, ladera W del Iztaccihuátl, *Sánchez 8* (MEXU); Ixtapaluca, Estación Experimental de Enseñanza y Investigación de Zoquiapan, *Koch & Magaña 75242* (MEXU, MO, NY); Llano Grande Gap, near Río Frío, *Sharp 4496* (MEXU, RSA); Nat. Park Lagunas de Zempoala, *Cole 49* (MEXU), *McAdams 57* (MICH), *Traylor 55* (MEXU); Comunidad, Temascaltepec, *Hinton 860* (GH, NY, POM); Cumbre, Temascaltepec, *Hinton et al. 7478* (GH, LL, MICH [2], MO, NY, POM, TEX, UC, US); Cumbre Trojes, Temascaltepec, *Hinton et al. 8272* (MEXU, MICH, NY, UC, US); Mt. Popocatapetl, *Nelson 10* (US); 10 km al NE del Entronque a Sultepec, *Flores & Terpán 829* (MEXU); Vallee de Bravo, 0.8 mi. S of Cajones, 9500 ft., *Balogh 1005* (US); 55 km SE of Mexico City, 10,500 ft., *Weaver 712* (POM, US); near Toluca, *Schery 64* (MO); Ocuilan, *Matuda 32454* (MEXU). **Michoacán:** near base of Cerro de Tecolote near Zacapu, *Sharp 45531* (RSA); Cerro del Burro, Santa Clara del Cobre, *Pérez 53* (MEXU, MO), *Escobedo 1400* (MO); Cerro Prieto, Nuevo Parangaricutiro, *Medina 2684* (MEXU); En El Salto, a 7 km al E de Ocampo, Melchor Ocampo, *Martínez & Torres 419* (MEXU); Ocampo, 11 km al SE de Ocampo, en el Cerro El Chivati, *Soto Núñez & Solórzano 12609* (MEXU); Queréndaro, cerca de San José de la Cumbre, *Santos 1301* (MEXU); ladera SW del Cerro San Andrés, Zinapécuaro, *Zamudio 5520* (MEXU, MO); lado N de La Presa La Gachupina, *Jasso 1029* (MEXU); ca. 18 mi. S of Pátzcuaro, *King & Soderstrom 5189* (TEX, US); near Paricutin volcano, *Eggler 34* (US). **Morelos:** km 48, carretera federal, *Vázquez 1871* (MEXU [2]); Lagunas de Zempoala, **Straw & Gregory 1068* (GH, MEXU, MICH, RSA, UC); Huitzilac, ladera NE del Lago Hueyapan, Parque Nacional Lagunas de Zempoala, *Avonce s.n.* (MEXU). **Puebla:** 4 km E of Río Frío, *Roe et al. 343* (MICH, US); side of Popocatepetl, *Miranda & Barkley 17M200* (F, TEX); El Salto, Río Frío, *Boege 3073* (MEXU). **Veracruz:** Lomogrande, Mt. Orizaba, *Balls 4377* (UC, US). Without locality: *Gregg 697* (MO).

Oenothera orizabae W. L. Wagner, nom. nov. *Hartmannia montana* Rose, Contr. U.S. Natl. Herb. 8: 329. 1905, non *Oenothera montana* Nuttall, in Torrey & Gray, Fl. N. Amer. 1: 500. 1840. TYPE: Mexico. El Cima, on the railroad between México, D.F., and Cuernavaca, México, 19 Sep. 1903, *J. N. Rose & J. H. Painter 7170* (holotype, US-00450745; isotypes, GH, MEXU, NY, US). Figure 3.

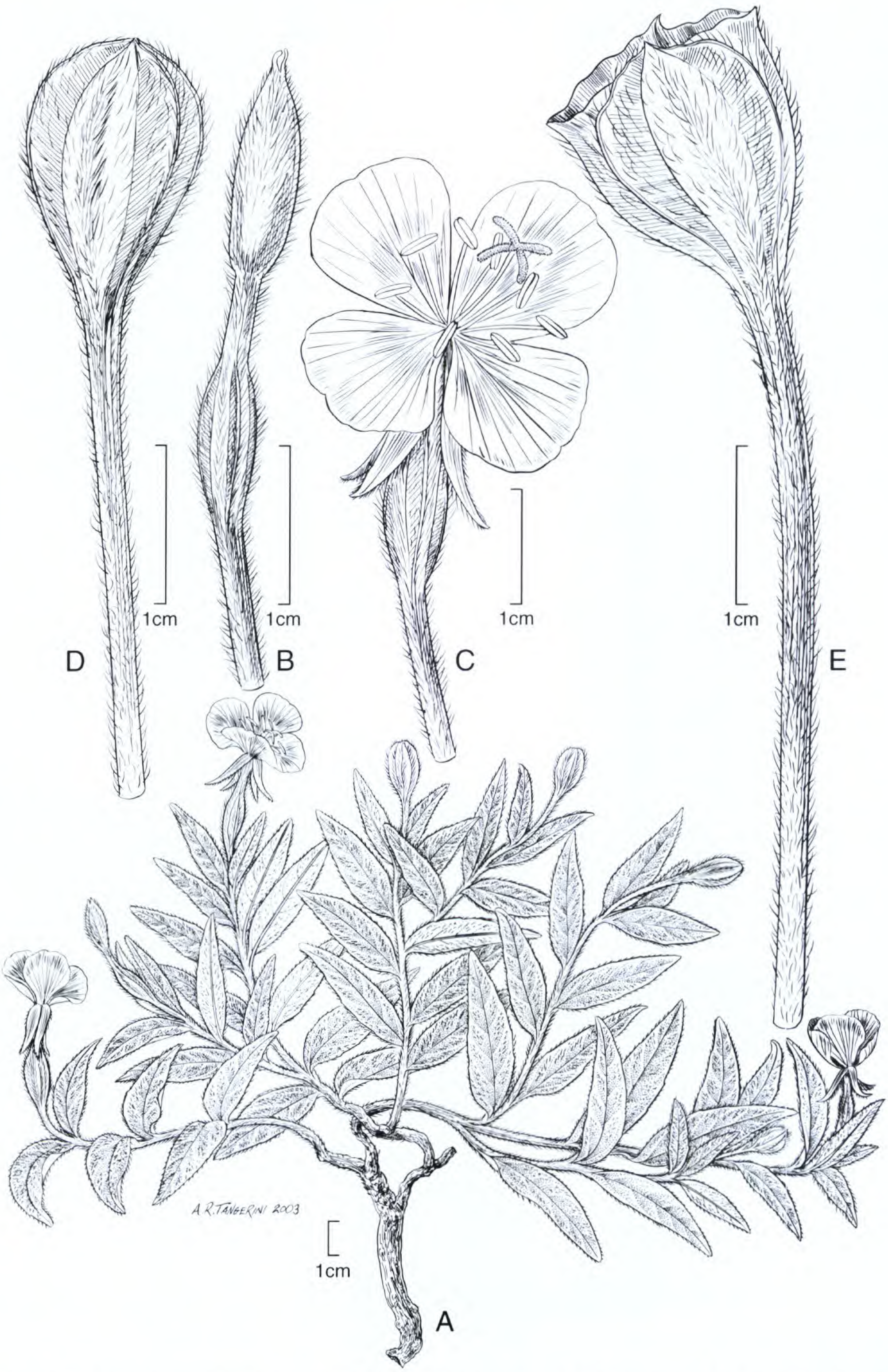

Figure 3. *Oenothera orizabae* W. L. Wagner. —A. Habit, showing decumbent stems from a multi-stemmed base (*Straw & Gregory 1120,* GH). —B. Bud, floral tube, and ovary, showing the free sepal tips and pubescence pattern (*Straw & Gregory 1120,* GH). —C. Flower, showing petal shape and expected non-overlap of petals (*Straw & Gregory 1120,* MICH). —D. Young capsule, showing shape, wings, rounded apex, and sterile stipe (*Rose & Painter 7170,* holotype, US). —E. Dehisced capsule, showing known length of dehiscence (*Rose & Painter 7170,* isotype, US).

Perennial herb with several decumbent to ascending, simple or usually branched stems, 6–46 cm long, the plant hirtellous throughout. Rosette leaf blades 3–5 × 0.9–1.5 cm, elliptic to oblanceolate, hirtellous; petioles 0.3–1 cm long. Cauline leaf blades 3–9 × 1–3 cm, narrowly ovate, occasionally elliptic, subentire to subdenticulate; petiole 0.1–2.2 cm long. Flowers opening near sunset; floral tube, sepals, and ovary densely hirtellous with hairs up to 1.5 mm long; floral tube 9–15 mm long; sepals 15–20 mm long; free tips in bud 1.7–2 mm long; petals 18–22 mm long, white, fading purple; filaments 15–16 mm long, pale maroon; anthers 3–7 mm long, cream; pollen cream-colored, > 90% fertile; style 20–28 mm long; stigmas held above the anthers at anthesis, the lobes 4–5 mm long. Capsule body 15–26 mm long, obovoid, apex rounded, the margins winged, the wings 2.3–4 mm wide; the sterile stipe stout, 15–50 mm long; capsule body apparently dehiscing only at apex; seeds 1–1.4 mm long, 0.5–0.7 mm thick, brown. Gametic chromosome number, $n = 7$ (forming 7 pairs at meiotic metaphase I; Gregory & Klein, 1960; Raven, unpublished).

Distribution. *Oenothera orizabae* is scattered in rocky grasslands in *Pinus-Quercus* forest at middle elevations in the Trans-Mexican Volcanos from Morelos and México to El Chico to the north in Hidalgo, and Pico Orizaba in Veracruz, at 2980–3000 m.

Oenothera orizabae appears to be allied to a group of evening-flowering species with white petals currently assigned to section *Hartmannia*, including *O. kunthiana* (Spach) Munz, and *O. tetraptera* Cavanilles, but based on recent molecular studies this white-petaled group may need to be distinguished as a separate section (Levin et al., 2004). Another white-flowered species, *Oenothera dissecta* A. Gray ex S. Watson, may also belong in this group, but was most recently assigned to section *Gauropsis* (Wagner, 1984). A single collection was examined for pollen fertility using Alexander stain (Alexander, 1969).

*Specimens examined (those marked by * are chromosome determination vouchers and voucher for pollen fertility indicated by +).* MEXICO. **Distrito Federal:** 1 mi. SE of Puerto del Aire, *Barkley et al. 2438* (MICH, TEX) [both sheets mixed with *O. deserticola*]; Estación La Cima, *Pringle 10293* (F, GH, MEXU [2], MICH [2], MO, NY, UC, US), **Raven s.n. (Stanford greenhouse #67-354*; flavonoid voucher) (TEX); Colonia del Valle, *Lyonnet 198* (US); ca. 2 km SSW of La Cima R.R. Station, old Hwy. 95, *Iltis et al. 200* (MICH, RSA); Volcán Pelado, ladera W, *Sandoval 230* (MEXU). **Hidalgo:** El Chico, *Lyonnet 2205* (MEXU). **México:** S of Mexico City, *Leavenworth & Leavenworth 954* (F); 55 mi. SE of Mexico City, *Weaver 713* (POM); near Gap, near Río Frío, *Sharp 4495* (MEXU, RSA); public park area W of divide betw. México & Puebla at the Estacionamento, *Pennell et al. 125* (MO); 1 km al N de Llano Grande sobre la ladera S del Telapón, *Espinosa 542* (MO); Llano Grande, Telapón, +*Lyonnet 689* (MEXU [2], US); near Río Frío, Puebla hwy., **Straw & Gregory 1120* (GH, MEXU, MICH [2], RSA); Río Frío, *Kenoyer 2485* (GH); just W of Río Frío, 40 mi. E of Mexico City, *Manning & Manning 53656a* (GH). **Morelos:** Cuernavaca, *Kenoyer A422* (F); 6 mi. W of Yautepec, *Walther 133* (MICH). **Veracruz:** Pico de Orizaba, *Rose & Hay 5672* (US).

Oenothera luciae-julianiae W. L. Wagner, sp. nov. TYPE: Mexico. Durango: San Dimas, Mesa del Roble, San Miguel de Cruces, 24.99°N, 105.99°W, 2740 m, 26 May 1990, *A. García & S. Acevedo 345* (holotype, US-3441077; isotypes, ANSM, CHAPA, CIIDIR, ENCB, IEB, MEXU, UAMIZ (none seen)). Figure 4.

Ab *Oenothera orizabae* caulibus erectis ad adscendentes, laminis foliorum caulinorum 0.5–1.1(–3) cm latis ellipticis ad lanceolatas et denticulatis ad serrulatas, corpore capsulae 8–18(–25) mm longo clavato vel anguste obovoideo ad apicem obtuso vel acuminato alis ejus 1.3–2 mm latis stipite sterili tenui 7–35 mm longo.

Perennial herb with few to several, ascending to erect, simple or occasionally branched stems, the longer ones becoming decumbent and often developing lateral branches, 20–50(–90) cm long, sparsely (very sparsely) to moderately hirtellous, the hairs 1.5–2.5 mm long, also strigillose throughout or only in the upper portions of the stem, the hairs mostly 0.3–0.4 mm long; root a thickened, often branched taproot. Rosette leaf blades 4–10 × 0.5–2.5 cm, oblanceolate, denticulate to serrulate, or weakly sinuate-toothed, sparsely to moderately strigillose, apex obtuse to rounded; petiole 0–1.5 cm long; cauline leaf blades (1.8–)3–7 × 0.5–1.1(–3) cm, elliptic to lanceolate or narrowly elliptic-ovate, denticulate to serrulate, apex attenuate, acute, sparsely to moderately strigillose; petiole 0–0.5 cm long. Flowers opening near sunset; floral tube, sepals, and ovary moderately to occasionally densely strigillose and rarely with scattered hirtellous pubescence with hairs up to 1.5 mm long; floral tube 12–21 mm long; sepals 14–24 mm long; free tips in bud 1–2 mm long; petals 16–26 mm long, white fading deep purplish red; filaments 7–10 mm long, rose-purple or yellow; anthers 4.8–6.5 mm long, cream; pollen cream, ca. 50–60% fertile (range 26–94%); style 20–30 mm long; stigma elevated above to surrounded by the shedding anthers at anthesis, the lobes 3.6–6 mm long. Capsule body 8–18(–25) mm long, gray-green, clavate or narrowly obovoid, apex obtuse to bluntly acuminate, winged in the upper part or throughout the

Figure 4. *Oenothera luciae-julianiae* W. L. Wagner. —A. Habit, showing ascending to erect stems from a several-stemmed base (*García & Acevedo 345*, US). —B. Bud, floral tube, and ovary, showing the free sepal tips and pubescence pattern (*Reveal & Harley 4095*, NY). —C. Flower, showing petal shape and apparent slight overlap (*García & Acevedo 345*, US). —D. Young capsule, showing shape, wings, obtuse to bluntly acuminate apex, and sterile stipe (*Reveal & Harley 4095*, TEX). —E. Dehisced capsule, showing known length of dehiscence, and valves (although they can be spreading) (*García & Acevedo 345*, US).

body, the wings 1.3–2 mm wide; sterile stipe slender, 7–35 mm long; capsule body dehiscing in upper half to nearly throughout; seeds clustered in each locule, 1.4–1.5 mm long, brown.

Distribution. *Oenothera luciae-julianiae* is scattered to common in open *Pinus* or *Pinus-Quercus* forests or mixed forests of *Abies*, *Pseudotsuga*, *Pinus*, *Quercus*, and sometimes with *Arbutus*, *Juniperus*, or *Cupressus*, on rocky or open sites, steep slopes, or moist flats or along streams in the Mexican mountains of the Sierra Madre Occidental from Chihuahua south through Durango, Guanajuato, Nayarit, Jalisco, Michoacán, and Querétaro, from 2100 to 2800(–3250) m. Flowering nearly throughout the year, and documented from February through November.

Etymology. It is a pleasure to name this attractive Sierra Madre Occidental species in honor of my wife, Lucy C. Julian, on the occasion of our 10th wedding anniversary.

Oenothera luciae-julianiae has gone undetected for decades of collecting in the Sierra Madre Occidental. The collections cited herein were determined most commonly as *O. deserticola* by P. H. Raven, myself, or others, but also occasionally as *O. purpusii*, *O. tetraptera*, or *O. kunthiana*. It was treated as part of *O. deserticola* (now correctly known as *O. orizabae*) by Raven and D. Parnell (pers. comm.) in their unpublished revision of section *Hartmannia*. Munz, who revised the section in 1932, never annotated any of the collections, as very few were made before 1960. J. N. Rose, however, annotated a single collection from Chihuahua (*Nelson 4848*) as a new species, but he never published it. *Oenothera luciae-julianiae* appears to be allied to a group of evening-flowering species with white petals currently assigned to section *Hartmannia*, including *Oenothera orizabae*, *O. kunthiana* (Spach) Munz, and *O. tetraptera* Cavanilles.

Like *Oenothera kunthiana* of this white-flowered species group of section *Hartmannia*, *O. luciae-julianiae* appears to be a permanent translocation heterozygote (PTH) species. In PTH species a ring of 14 chromosomes is usually formed in meiotic metaphase. I have not yet been able to obtain cytological material to examine meiosis in this species, and thus current data are only suggestive of this condition in *O. luciae-julianiae*. PTH species in the Onagraceae are nearly always autogamous (Raven, 1979). The stigma is usually surrounded by the shedding anthers at anthesis in *O. luciae-julianiae*, suggesting that it is predominately autogamous. Another feature of PTH species is the balanced lethals in pollen and ovules, which can be observed in lowered pollen fertility and fewer mature seeds (see Cleland, 1972). I examined pollen fertility of as many collections as possible of *O. luciae-julianiae*. In the 15 collections I examined with Alexander stain (Alexander, 1969; vouchers noted with brackets in the exsiccatae) pollen fertility ranged from 26% to 94%, a very wide range, but suggestive nevertheless that *O. luciae-julianiae* is probably a PTH species. Typically, PTH species have about 50% pollen fertility on average, but all exhibit a range of fertility. For example, *Oenothera nutans* G. F. Atkinson & Bartlett exhibited a similar wide range of fertility (48% to 84%) in a detailed study (Wasmund, 1990). Raven (1979) pointed out that most PTH species are annuals or biennials, with about 10% of the known PTH species in Onagraceae being perennial. If *O. luciae-julianiae* proves to be a PTH species, it will represent another atypical species, as it clearly has a perennial habit from an enlarged root. *Oenothera luciae-julianiae* does not appear to be closely related to other species of the white-flowered species group of section *Hartmannia*. It may share a common ancestor with *O. tetraptera*, an outcrossing pair-forming species that appears to be directly related to the other PTH species in this group, *O. kunthiana*.

Paratypes (those used to study pollen fertility have % fertile pollen given in square brackets). MEXICO. **Chihuahua:** ca. 51 mi. S of Creel, *Straw & Forman 1900* (RSA) [26%]; Llano Grande, *Pennington 181* (TEX) [37%]; Guachochi, 8 km al W de Cabórachi, *Hernández 8778* (MEXU); Ocampo, Cascada de Basaseachi, *Tenorio & Torres 4510* (MEXU); Urique, *Bye et al. 15612* (MEXU) [90%], *Tenorio et al. 9935* (MEXU) [62%]; base of Mt. Mohinora, 8 mi. from Guadalupe y Calvo, *Nelson 4848* (US). **Durango:** Canelas, *Bolaños 1565* (MEXU); 55–60 km SW of Durango City on road to La Flor, *Breedlove 44134* (MO); from the Sierra Madre, W of Durango, *Forrer 12* (UC); ca. 77 rd. km S of Durango by hwy. to La Flor, *Worthington 8826* (MO); 48 km WNW of Huejuquilla El Alto, Jalisco to Canoas, *Breedlove & Almeda 59165* (MO); 6 mi. E of Buenos Aires tow. El Salto, *Straw & Forman 1795* (RSA) [83%]; 31 mi. N of Estacion Coyotes, *Breedlove 18741* (MO); 54 mi. N Estacion Coyotes, just NW of Guachichilas, *Breedlove 18783* (MO) [59%]; 71 mi. W of Durango, E of La Campaña, *Oliver 715* (MO); 11 km SW of La Ciudad near Buenos Aires, *Breedlove 36465* (MO) [27%]; Hwy. 40, 11.5 mi. W of La Ciudad, *Wagner & Solomon 4303* (MO); Hwy. 40, at La Campana, *Reveal et al. 2689* (MO) [74%]; Hwy. 40, about 81 mi. W of Durango, *Reveal & Atwood 3477* (MO) [39%]; betw. Pinos Altos & Concheño, *Hewitt 118* (GH) [88%]; El Salto, El Tapextle, *Tenorio & Romero 816* (MEXU); 1 km al SW de El Salto, *Tenorio & Romero 927* (MEXU); "Arroyo de El Salto" al N de El Salto, *Tenorio & Romero 759* (MEXU); 17 mi. W of El Salto, *Waterfall 12693* (GH, US) [35%]; 25 mi. E of El Salto along Mexican Hwy. 40, *Breedlove 15753* (MO); 7 km W of Llano Grande, *Hendrickson 1704* (RSA) [72%]; ca. 120 road mi. NW of Santiago Papasquiaro, *Spellenberg & Zimmerman 6683* (MO, NMC); 10

mi. W of El Salto on Mazatlan rd., *Straw & Gregory 1270* (RSA); Sierra Madre Occidental, 5.1 rd. mi. by hwy. 40 SW of El Salto at Arroyo de Agua, *Worthington 8902* (MO); Durango, Ejido Ciénega de Los Caballos, *Ortega & Pacheco 81* (CIIDIR, IEB, MEXU, US); Ejido, Encina, *Ortega 20* (CIIDIR, US); El Mezquital, El Zapote, *Solís 902* (CIIDIR, US); La Guajolota, *García 260* (CIIDIR, US); Laguna del Chivo, *Acevedo 445* (CIIDIR, IBUG, US); Las Minas, *Solís 11* (CIIDIR, US); Nombre de Dios, San José de La Parrilla, *Sánchez 455a* (US), *544* (CIIDIR, US); Pueblo Nuevo, El Salto, *Valenzuela 3–25* (CIIDIR, US); Predio Las Bayas de la UJED, *García & Acevedo 980* (US); San Bernardino de Milpillas Chico, *Sánchez (INI) 9* (US), *19* (CIIDIR, US); San Francisco de Lajas, *I.N.I. 31* (CIIDIR, US); Santa Bárbara, *García 1137a* (US); San Dimas, Los Aposentos, *García et al. 435* (CIIDIR, US). **Guanajuato:** Guanajuato, Rincón del Toro, *Martínez 760* (MEXU [2]); Cañada de la Virgen, Agua Sabrosa, *Martínez 935* (MEXU); 34–35 mi. E of San Luis de la Paz tow. Xichu, *Straw & Forman 1474* (MEXU, RSA). **Jalisco:** 14–18 km SW of Tequila on Volcán de Tequila, *Breedlove 39226* (MO) [47%]; Volcán Tequila, *Reveal & Harley 4095* (F, MEXU, MO, NY, TEX) [94%]. **Michoacán:** betw. Los Cabras & Pueblito, Chilchota to Zacapú, *Sharp 45507* (RSA). **Nayarit:** 105 km WNW of Huejuquilla El Alto along road to Jesus Maria, *Breedlove 61508* (MO) [94%]. **Querétaro:** Colón, parte alta del Cerro Zamorano, *Rzedowski 44449* (MICH).

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Four New Species of *Nasa* ser. *Alatae* (Loasaceae) in the Amotape–Huancabamba Zone of Peru

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ABSTRACT. Four new species of *Nasa* ser. *Alatae* (Urban & Gilg) Weigend are described from the Amotape–Huancabamba Zone in northern Peru. The new species *Nasa stolonifera* has extensive underground stolons and forms clonal stands, whereas *N. victorii* has angular stems with elevated longitudinal ridges. New species *Nasa pongalamesa* and *N. lambayequensis* are closely allied to *N. carnea* from northern Peru and *N. loxensis* from Ecuador. *Nasa amaluzensis* Weigend, previously only known from the type collection in southern Ecuador, is reported as new to the Peruvian flora. The flowers of *Nasa* ser. *Alatae* are discussed as funnel-revolver flowers, based on their morphology. A distribution map of the newly described taxa and a key to all known species of *Nasa* ser. *Alatae* in Peru are provided.

Key words: Amotape–Huancabamba Zone, funnel-revolver flower, Loasaceae, *Nasa* ser. *Alatae*, Peru.

A revision of *Nasa* ser. *Alatae* in Peru was recently provided together with an overview of its morphology and ecology (Weigend, 2000a). *Nasa* ser. *Alatae* was originally described as *Loasa* subg. *Loasa* ser. *Alatae* Urban & Gilg (Urban & Gilg, 1900), but has since been removed to the new genus *Nasa* and includes the type of this genus (*Nasa rubrastra* (Weigend) Weigend). *Nasa* ser. *Alatae* is closely allied to *Nasa* ser. *Grandiflorae*, and its precise limits are currently under investigation (Weigend et al., in prep.). Both groups share more or less campanulate corollas usually with yellow, red, or orange petals and floral scales with distinct apical wings.

The series as currently defined comprises ca. 27 species, which range throughout the northern and central Andes (southern limit in south-central Peru with an outlier in northern Bolivia) and are usually restricted to the moister eastern slopes in the drier central Andes. The geographical range has been recently expanded northward by the description of a new species from Central America (*N. panamensis* Weigend, Weigend, 2002b). The species here described reported from Peru bring the species total of *Nasa* ser. *Alatae* in the strictest sense (i.e., sensu Urban & Gilg, 1900) up to 17 from 13 in the year 2000, and an original number of only 5 species before the beginning of the current revisionary effort. The species totals known for Colombia and Ecuador are 7 and 8, respectively, so that Peru now houses more than twice as many species as each of these other two countries. This has nothing to do with the different sizes of the countries, since *Nasa* ser. *Alatae* in Peru is largely restricted to the northern part and there mostly to the eastern cordilleras, i.e., an area substantially smaller than their range in Ecuador and Colombia.

MATERIALS AND METHODS

New collections were obtained during field studies in Peru in October 2000 and March–April 2001 in addition to the collections cited in Weigend (2000a); vouchers are cited under the respective species below. Pressed specimens, FAA-material, and photographs are available from these collections. Duplicates have been sent by Asunción Cano E. from USM, Segundo Leiva G. (Herbario de La Universidad Antenor Orrega, Trujillo, Peru), and Víctor Quipuscoa S. from HUSA (Universidad Nacional de San Augustin, Arequipa, Peru). Also, two species, *N. olmosiana* (Killip) Weigend and *N. pongalamesa*, have been taken into cultivation in Berlin.

NASA SER. *ALATAE* IN THE AMOTAPE–HUANCABAMBA ZONE

The Amotape–Huancabamba Zone has been postulated as a particular center of diversity for the Loasaceae (Weigend, 2002a), and this fact is further underscored by the four new species and the new record. All five species here discussed are found in the area called the Amotape–Huancabamba Zone (Fig. 1, Ayers, 1999; Berry, 1982; Young & Reynel, 1997) and close apparent distribution gaps of *Nasa* ser. *Alatae* (Weigend, 2000a). The species show the narrow endemicity and morpho-

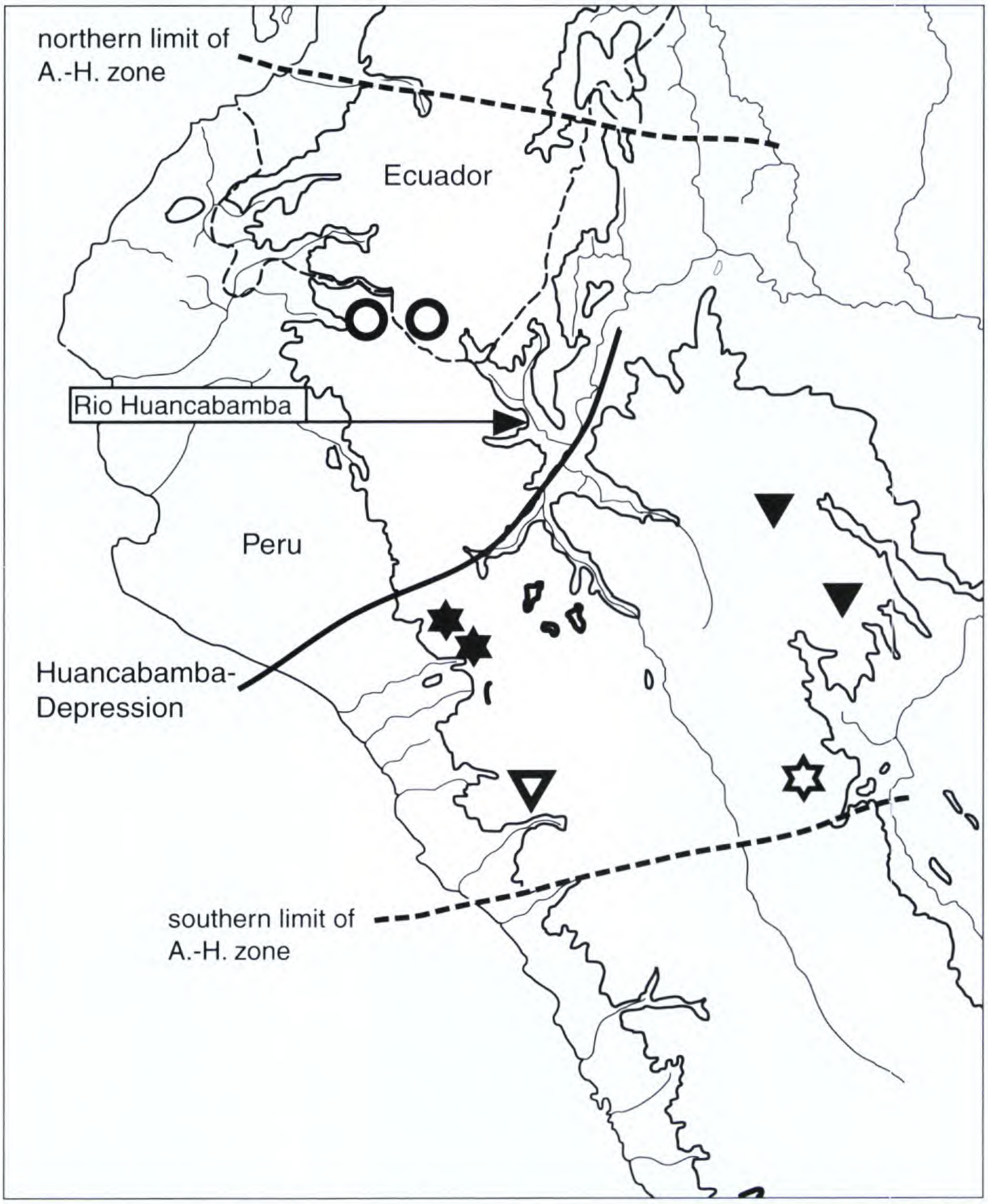

Figure 1. Distribution of the newly described and the newly reported species of *Nasa* ser. *Alatae*. Bold circles: *Nasa amaluzensis* (Weigend) Weigend; black stars: *Nasa lambayequensis*; empty star: *Nasa stolonifera*; inverted black triangles: *Nasa victorii*; inverted empty triangle: *Nasa pongalamesa* (map modified from Weigend, 2002a).

logical divergence that is so typical of many plant species in this geographical region. A total of 14 of the 17 species of *Nasa* ser. *Alatae* known from Peru are endemic to the Peruvian part of the Amotape–Huancabamba Zone, another 3 species are found in both the Ecuadorean and the Peruvian part of the Amotape–Huancabamba Zone, and 1 species is endemic to the Ecuadorean part of the Amotape–Huancabamba Zone. This means that more than 50% of all the known species of *Nasa* ser. *Alatae* are restricted to that relatively small zone, in spite of the fact that the group is widespread and ranges from central Peru to Panama.

Nasa ser. *Alatae* comprises mostly narrowly endemic species, and all the newly described taxa fall into that category. In some cases apparent narrow endemicity may reflect a lack of collecting, especially in the poorly known cloud forests on the eastern slopes of the Andes. This is borne out by the fact that some species previously known from only one locality have now been recollected at different places (e.g., *N. lenta* (Urban & Gilg) Weigend). *Nasa* ser. *Alatae* are usually plants from cloud and mistbelt forests, with only very few species ranging either into paramo habitats (e.g., *N. loxensis* (Kunth) Weigend from Ecuador, the new species *N.*

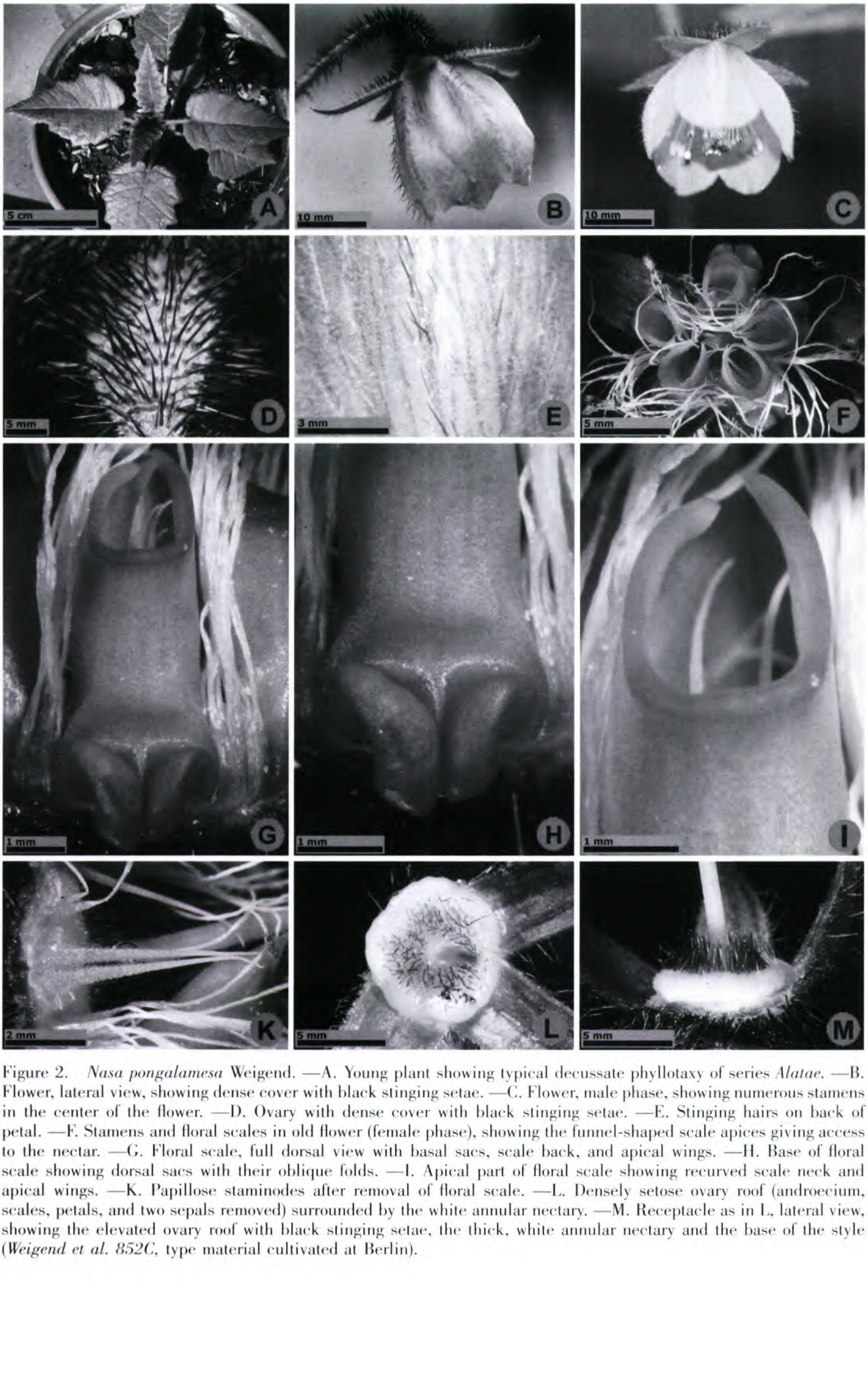

Figure 2. *Nasa pongalamesa* Weigend. —A. Young plant showing typical decussate phyllotaxy of series *Alatae*. —B. Flower, lateral view, showing dense cover with black stinging setae. —C. Flower, male phase, showing numerous stamens in the center of the flower. —D. Ovary with dense cover with black stinging setae. —E. Stinging hairs on back of petal. —F. Stamens and floral scales in old flower (female phase), showing the funnel-shaped scale apices giving access to the nectar. —G. Floral scale, full dorsal view with basal sacs, scale back, and apical wings. —H. Base of floral scale showing dorsal sacs with their oblique folds. —I. Apical part of floral scale showing recurved scale neck and apical wings. —K. Papillose staminodes after removal of floral scale. —L. Densely setose ovary roof (androecium, scales, petals, and two sepals removed) surrounded by the white annular nectary. —M. Receptacle as in L, lateral view, showing the elevated ovary roof with black stinging setae, the thick, white annular nectary and the base of the style (*Weigend et al. 852C*, type material cultivated at Berlin).

pongalamesa) and into dry scree-slope habitats (*N. urentivelutina* Weigend).

Floral Morphology

The basic structure and terminology of the floral elements of *Nasa* ser. *Alatae* have been discussed previously (Weigend, 2000a) and are largely congruent with the morphology observed in *Nasa* ser. *Grandiflorae*. The finer detail, especially petal shape, color, and orientation, size and shape of the scale back, presence or absence of dorsal threads, and the orientation and shape of the apical wings are crucial for taxon delimitation. A detailed overview is here provided on the basis of photographs of cultivated *Nasa pongalamesa* (Fig. 2). The pentamerous flowers have a largely inferior ovary, five calyx lobes, and five membranaceous, shallowly cymbiform petals (Fig. 2B, 2C). The petals are usually setose on the back (Fig. 2C, 2E), but stinging hairs are usually densest on the ovary (Fig. 2D). The flowers are proterandric and the mature anthers are folded into the center of the flower during the male phase; during the female phase the stigma elongates and is then situated in the center of the flower, while the anthers have by then wilted (Fig. 2F). The floral scales seen from above (i.e., in the flower visitor's view) form a typical "revolver" (Fig. 2F), i.e., each scale apex forms a funnel (Fig. 2H, 2I) that guides the beak of visiting hummingbirds to the basal nectar reservoir (Fig. 2H).

The term revolver flower is generally used for flowers where there is more than one access point to the nectariferous part (Endress, 1994: 116). In *Nasa* ser. *Alatae* (and most Loasaceae subfam. Loasoideae) there are five nectaries, each covered by a floral scale and two staminodes, and thus each floral scale has to be probed to extract all the nectar from an individual flower. Each floral scale forms a distally widened funnel providing mechanical guidance to the nectaries and also ensuring direct contact of the beak or the head of the visiting hummingbird with either the anthers or the stigma. This is a very peculiar case of a revolver flower, and I would like to introduce the term funnel-revolver flower for this particular situation. The basal nectar sacs are not the place where the nectar is secreted; they only function as nectar storage containers. Nectar secretion takes place in five basal nectaries (Fig. 2L, 2M), and nectar is secreted between the bases of the two free staminodes (Fig. 2K) into the base of the nectar scale. The ovary roof, i.e., the receptacle within the nectary, is densely covered with stinging hairs (Fig. 2M), presumably to deter nectar theft by small insects, which could otherwise land on the nectar scales, climb onto the receptacle, and then remove the nectar from the scales without touching either anthers or stigmas.

Key to the Taxa of *Nasa* ser. *Alatae* in Peru

1. Calyx tube and fruit without stinging hairs . . . . . *Nasa anderssonii*
1′. Calyx tube and fruit usually densely covered with stinging hairs, at least in proximal portion 2
2(1). Stem with strongly elevated longitudinal ridges (usually 6); stinging hairs on ovary concentrated at base, distal portion with very few, or without stinging hairs . . . . *Nasa victorii*
2′. Stem terete, never with elevated ridges; stinging hairs ± evenly distributed on fruit, usually very numerous 3
3(2). Leaves pentagonous with acute leaf lobes; stem densely covered with uniseriate glandular hairs, especially in distal portion, setae 4–5 mm long; petals narrowly oblong and setose on back . . . . . *Nasa amaluzensis*
3′. Leaves ovate to widely ovate, if widely ovate then leaf lobes always rounded to acuminate; stem without or with few uniseriate glandular hairs, setae typically less than 4 mm long; lamina typically ovate, if subcircular in outline, then petals widely ovate to subcircular and esetulose on back 4
4(3). Corolla yellow, leaves dark green with white lines along primary and secondary veins adaxially . . . . . *N. driesslei*
4′. Corolla pink, orange, or red, never yellow, leaves without white line along veins or, if with white veins, then lamina bright green and flowers bright red (only *N. tingomariensis*, occasionally) 5
5(4). Inflorescence with large, sessile, semi-amplexicaul bracts; petals very deeply cymbiform and bright red; corolla balloon-shaped, rarely half spreading . . . . . *N. olmosiana*
5′. Inflorescence with petiolate or sessile bracts, these not semi-amplexicaul; petals variable in shape and color, often orange or pink; corolla campanulate or star-shaped, never balloon-shaped 6
6(5). Lamina very densely pubescent, velvety to the touch with numerous stinging hairs between the trichomes; vegetative shoots with numerous, mostly spirally inserted leaves (rarely opposite); stiffly erect, sparsely branched shrub; floral scales yellow with orange nectar sacs and apically with filaments . . . . . *N. urentivelutina*
6′. Lamina hairy and sometimes densely so, but never velvety to the touch; leaves never spirally inserted, opposite, internodes > 3 cm; plant often branched from base; floral scales red or yellow, nectar sacs not contrastingly colored 7
7(6). Leaves approximately as long as wide, dark green callus below insertion of petiole present; petals either very narrow (5–6 × as long as wide) or widely ovate, carnose and completely esetulose on back; capsule cla-

vate, erect on post-anthetically elongating pedicel 8
7′. Dark green callus below insertion of petiole absent; petals not narrow (< 4 × as long as wide); capsule variable in shape, but pedicel never elongating post-anthetically 10
8(7). Petals ovate (< 4 × as long as wide), carnose . . . . . *Nasa sagasteguii*
8′. Petals linear (5– > 6 × as long as wide), membranaceous 9
9(8). Leaves ovate, up to 90 × 50 mm; found in Piura . . . . . *Nasa solata*
9′. Leaves widely ovate to subcircular, 90–150 mm long and wide; Cajamarca . . . *Nasa dillonii*
10(7). Corolla brilliant red, inside of petals densely glandular distally; soft-stemmed rain forest herb with widely ovate leaves 100–180 mm long and wide, found below (2000–)1000 m . . . . . *N. tingomariensis*
10′. Characters not as above, leaves smaller, found only above 2200 m 11
11(10). Petals half-spreading and corolla star-shaped; floral scales white or pale yellow 12
11′. Petals erect and corolla campanulate; floral scales white, pale yellow, orange, or deep pink 13
12(11). Sparsely branched, stiffly erect herb with few to many yellow to red setae on stem and leaf veins; petals pink, half-spreading; Cajamarca: Bambamarca & Cutervo . . . . . *Nasa carnea*
12′. Much-branched stoloniferous herb or subshrub with numerous yellow to red setae on stem and leaf veins; petals orange; La Libertad: Bolívar . . . . . *Nasa stolonifera*
13(12). Erect shrubs; capsule turbinate to clavate, 2–2.5 × as long as wide; Cajamarca, Lambayeque, Piura 14
13′. Erect herbs or scandent shrubs; capsule globose or shortly turbinate, 1–1.5 × as long as wide; Amazonas, Pasco, Huánuco, San Martín 15
14(13). Leaves widely ovate, ca. 1.2–1.5 × as long as wide with 2 to 3 leaf lobes on each side; stem and pedicels densely glandular; petals orange; Lambayeque: Ferreñafe . . . . . *Nasa lambayequensis*
14′. Leaves ovate, ca. 2 × as long as wide with 5 to 7 lobes on each side; stem and pedicels sparsely glandular; petals pink; Cajamarca: San Miguel . . . . . *Nasa pongalamesa*
15(13). Erect herb with soft stems (collapsing upon drying); sepals 10–13 × 4.5–7 mm; petals 30–37 mm long, narrowly ovate, apically acuminate, deeply cymbiform, membranaceous; plant very densely covered with setae; Pasco, Junin . . . . . *N. pascoensis*
15′. Subscandent shrub with lignescent stems (not collapsing upon drying); sepals 8–10 × 2–4 mm; petals < 25 mm long, oblong, apically rounded, shallowly cymbiform to ± planar; plants sparsely setose to nearly esetulose 16
16(15). Petals widely ovate, dorsally with numerous red setae, membranaceous; Amazonas . . . . . *N. nubicolorum*
16′. Petals oblong, apically rounded, without setae, carnose; Huánuco, San Martín . . . *N. lenta*

1. Nasa lambayequensis Weigend, sp. nov. TYPE: Peru. Dept. Lambeyeque: Province Ferreñafe, Incahuasi, to Laguna Tembladera, 3000 m, 13 Sep. 1985, *A. Sagástegui A., D. Skillman, J. Mostacero & L. Ramírez 12872* (holotype, HUT; isotypes, F, MO). Figures 1, 3.

Haec species *N. pongalamesae* affinis, sed ab ea foliis late ovatis ambobus lateribus lobis 2 vel 3 instructis (nec anguste ovatis ambobus lateribus lobis 5–7 instructis), corolla aurantiaca (nec rosea) atque caule apicem versus dense (nec parce) glanduloso differt.

Strictly erect shrub up to 1.5 m tall; stem filled with white pith, to 0.5 cm diam., densely covered with red-brown setae to 3 mm long and scabrid hairs, young parts of the plant and pedicels very densely covered with uniseriate, gland-tipped, white trichomes consisting of 2 to 5 cells each. Leaves opposite, petioles 30–45 mm long, densely setose; lamina ovate, 50–75 × 50–65 mm, membranaceous, base shallowly cordate (sinus 4–6 mm deep), apex acuminate, margin lobed with 2 to 3 widely triangular lobes on each side, each 10–15 × 17–20 mm, lobe margin serrate; abaxial surface setose on veins, otherwise covered with scabrid-glochidiate hairs (0.7–1 mm), adaxial surface densely setose and densely covered with longer scabrid hairs (ca. 1 mm); venation pinnate with 2 to 3 lateral veins on each side. Inflorescence a terminal monochasium, rarely dichasium, 10–20 cm long, with 5 to 8 pendent flowers, bracts subsessile, up to 30 × 12 mm; pedicel 20–40 mm long. Calyx very densely setose, tube conical to ovoidal, 5–6 × 5 mm, calyx lobes 5, ovate-acuminate, 12–14 × 5 mm, densely setose and covered with scabrid trichomes on the outside; corolla widely campanulate; petals obovate, cymbiform, 18–22 × 10 mm, apex rounded to slightly acuminate, abruptly widening ca. 5 mm from base, densely setose and set with scabrid and glochidiate hairs on back, with gland-tipped, 3-celled uniseriate trichomes, orange; nectar scales 5, with rectangular back, 8 × 2 mm, base incurved, basally on back with two depressed globose sacs 2 mm diam., pale red, scale neck slightly thickened, recurved and deeply red, without filiform appendages, laterally protracted into 2 incurved, suberect wings 4 × 1.5 mm; staminodia 2 per scale, 7 mm long, base dilated, 1 mm wide, filiform above, base curved, papillose, pale yellow; stamens numerous, in 5 epipetalous fascicles of 12 to 14 each; filaments 12 mm long, white, anthers 1 × 0.5 mm, black. Capsule clavate, crowned with the persistent calyx lobes, pedicel erect, 25–35 mm long, capsule 20–25 × 10 mm, very densely red setose, covered with very short, white, glochidiate

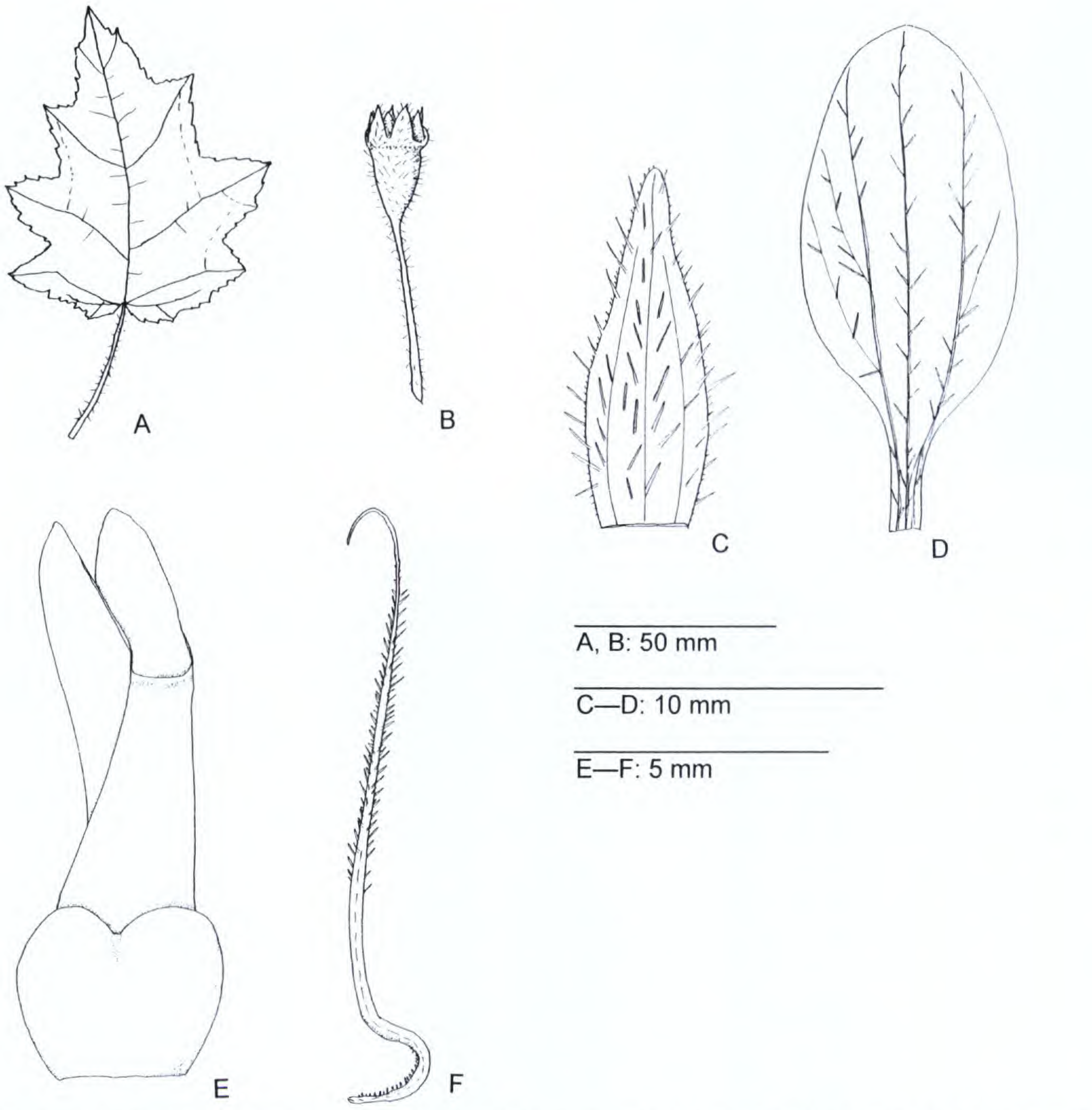

Figure 3. *Nasa lambayequensis* Weigend. —A. Leaf. —B. Capsule. —C. Sepal. —D. Petal. —E. Floral scale. —F. Staminode, lateral view. (Drawn from *Sagástegui et al. 12872*, HUT.)

and scabrid trichomes and uniseriate, gland-tipped trichomes, opening with 3 apical valves; seeds numerous, ovoid, testa reticulate.

Nasa lambayequensis has been collected in flower and fruit in August and September, but is likely to show peak flowering toward the end of the rainy season in late April and May; no detailed field data are so far available. *Nasa lambayequensis* is evidently closely allied to *N. pongalamesa* described below. They share the shrubby, poorly branched habit and grow in similar situations along rocks and dry stone walls in jalca (dry paramo of Peru) habitats. It differs from *N. pongalamesa* and closely allied *N. carnea* in leaf shape (widely ovate with 2 to 3 lateral lobes vs. ovate blades with more than 4 lateral lobes), petal color (orange vs. pink), and its much denser glandular indument. Both *N. pongalamesa* and *N. lambayequensis* are segregates of *N. carnea* (Urban & Gilg) Weigend s.l. (sensu Weigend, 2000a), and the material here referred to the new species was previously treated under that taxon. The three taxa are allopatric, with both new species found on the western slope of the Andes, while *N. carnea* is restricted to inner Andean valleys in the Central Cordillera (centered around Dept. Cajamarca, Prov. Bambamarca). The northern specimens of what now remains in *N. carnea* (e.g., Dept. Cajamarca, Prov. Cutervo) remain problematical, and field studies will be required to clarify where they actually belong, since the available herbarium material is unsatisfactory.

Paratypes. PERU. **Dept. Lambeyeque:** Prov. Ferreñafe, between Incahuasi and Sinchihual, 3000 m, 25 Aug. 2000, *A. Sagástegui A. & M. Zapata 16279* (HAO, HUT, M).

2. Nasa pongalamesa Weigend, sp. nov. TYPE: Peru. Dept. Cajamarca: Prov. San Miguel de Pallaques, Road Agua Blanca to Oyotun, pass height "Ponga la Mesa," 3500–3600 m, 14 Oct. 2000 (cultivated in Berlin since Sep. 2002), *M. Weigend, H. Förther, N. Dostert & E. Rodriguez R. 2000/752C* (holotype, USM; isotypes, BM, BSB, HUT, M, MO, NY, W). Figures 1, 2, 4.

Haec species *N. carneae* affinis, sed ab ea habitu fruticis rigide erectis (nec herbae arcte ramosae), squamis nectariferis roseis (nec luteolis) et corolla campanulata (nec stellata) differt.

Strictly erect shrub 1–2 m tall; stem filled with white pith, to 1.5 cm diam., densely covered with reddish brownish setae to 3 mm long and scabrid hairs, young parts of the plant and pedicels with scattered to many uniseriate, gland-tipped, white trichomes consisting of 2 to 5 cells each. Leaves opposite, petioles 30–55 mm long, densely setose; lamina ovate, 100–170 × 50–70 mm, membranaceous, base shallowly cordate (sinus 3–5 mm deep), apex acuminate, margin lobed with 5 to 7 widely triangular lobes on each side, each 7–12 × 15–18 mm, lobe margin serrate; abaxial surface very densely setose on veins and covered with glochidiate hairs (0.5 mm), adaxial surface sparsely setose and densely covered with longer scabrid hairs (ca. 1 mm); venation pinnate with 3 to 5 lateral veins on each side. Inflorescence a terminal monochasium, rarely dichasium, 20–50 cm long, with 8 to 12 pendent flowers, bracts petiolate, up to 55 × 18 mm; pedicel ca. 20 mm long, calyx very densely setose, tube conical to ovoidal, 6–7 × 4 mm, calyx lobes 5, ovate-acuminate, 13–15 × 5 mm, densely setose and covered with scabrid trichomes on the outside; corolla widely campanulate; petals obovate, cymbiform, 20–25 × 15 mm, apex rounded to slightly acuminate, abruptly widening ca. 2 mm from base, setose and set with scabrid and glochidiate hairs on back, with gland-tipped, 3-celled uniseriate trichomes, pale pink; nectar scales 5, with rectangular back, 6 × 2 mm, base incurved, basally on back with two depressedly globose sacs 2 mm diam., pale red, scale neck slightly thickened, recurved and deeply red, without filiform appendages, laterally protracted into two incurved, suberect wings 3 × 2 mm wide; staminodia 2 per scale, 7 mm long, base dilated, 1 mm wide, filiform above, base curved, papillose, pale pink; stamens numerous, in 5 epipetalous fascicles of 12 to 14 each; filaments 12 mm long, white, anthers 1 × 0.5 mm, black. Capsule clavate, crowned with the persistent calyx lobes, pedicel erect, 25–35 mm long, capsule 25–30 × 10 mm, very densely black setose and covered with very short, white, glochidiate trichomes, opening with three apical valves. Seeds numerous, ovoid, testa reticulate.

Nasa pongalamesa was encountered in fruit in October 2000, i.e., in the middle of the dry season. Like most species of *Nasa* in the region, it likely flowers March to May at the end of the rainy season.

Nasa pongalamesa is closely allied to three other species, *N. carnea* (Urban & Gilg) Weigend, *N. urentivelutina* Weigend (Weigend, 2000), and *N. lambayequensis* (see above). It differs from *N. carnea*, e.g., by the stiffly erect habit and perennial growth form with a strongly lignified stem, a very dense cover with dark red-brown stinging hairs (vs. stinging hairs scattered, pale brown), and the presence of stinging hairs on the back of the petals. *Nasa urentivelutina* differs in apricot-colored petals (vs. pink), densely spiral phyllotaxis (vs. opposite leaves), and a much more strongly branched habit (shrubs may be as large as 2 × 1.5 m). Its floral scales have a back that is very strongly narrowed above the nectar sacs and ends in three apical filiform appendages, whereas the scales of *N. pongalamesa* are only slightly narrowed above the sacs and have no filiform appendages.

The new species is also ecologically clearly differentiated: It grows on an exposed ridge with strong cloud condensation at an elevation of ca. 3500 m between rocks in otherwise grassy puna vegetation. *Nasa carnea*, on the other hand, grows in shrub forest in inner Andean valleys at ca. 2200–3000 m, and *N. urentivelutina* is restricted to dry scree slopes in full sun at elevations below 3000 m. *Nasa pongalamesa* is thus the species of *Nasa* ser. *Alatae* that reaches the highest elevation so far known from this group and is found together with a species of the *N. cymbopetala* group, the typical puna group in the genus.

Nasa pongalamesa was found in fruit only in October 2000 and was then brought into cultivation in the greenhouses of the Institute of Biology in Berlin. The type specimens were prepared from the cultivated material when it came into flower. *Nasa pongalamesa* is named after the locality of the original collection, "Ponga la Mesa" (lay the table). The epithet is here used as a noun in apposition, with its spelling not changed, sensu Article 23.5. of the ICBN (Greuter et al., 2000).

Paratypes. PERU. **Dept. Cajamarca:** Prov. San Miguel de Pallaques, road Agua Blanca to Oyotun, pass height "Ponga la Mesa," 3500–3600 m, 14 Oct. 2000, *M. Weigend et al. 2000/752* (BSB, HUT, M, USM).

Figure 4. *Nasa pongalamesa* Weigend. —A. Habit. —B. Flowering monochasium. —C. Sepal. —D. Petal. —E, F. Floral scale, dorsal and lateral view. —G, H. Staminode, lateral and dorsal view. (Drawn from *Weigend et al. 2000/725-C*, BSB.)

3. Nasa stolonifera Weigend, sp. nov. TYPE: Peru. Dept. La Libertad: Prov. Bolívar, road from Balsas (on the Marañon river) to the city of Bolívar, km 100 from Balsas, a few kilometers before Bolívar, remnant of *Alnus acuminata* forest in ravine with permanent water course, in deep, humus rich soil, 07°07′53″S, 077°44′30″W, 17 Oct. 2000, *M. Weigend, H. Förther, N. Dostert & E. Rodriguez R. 2000/822* (holotype, USM; isotypes, BSB, HUT, M). Figures 1, 5.

Haec species *N. driessleae* affinis similisque, sed ab ea foliis sine striis albis, caule bene evoluto et corolla aurantiaca (nec pallide flava) differt.

Erect to ascending herb 0.6–1.3 m tall, stem terete, filled with white pith, to 0.5 cm diam., densely set with yellow to pale red setae 1–3 mm long and densely covered with scabrid hairs, eglandular; underground stolons 10–30 cm long present, pale yellow, pubescent, forming new flowering shoots. Leaves opposite, petioles 32–45 mm long, setose; lamina widely ovate, 100–130 × 55–90 mm, membranaceous, base subtruncate (sinus < 2 mm deep), apex acuminate, margin lobed with 5 to 7 widely triangular lobes on each side, each up to 13 × 30 mm, lobe margin irregularly serrate to denticulate; abaxial surface setose on veins and covered with numerous scabrid hairs (0.2 mm), adaxial surface setose on veins and densely covered with longer scabrid hairs (0.3 mm); venation pinnate with 3 to 5 lateral veins on each side. Inflorescence a terminal monochasium 15–20 cm long, with up to 6 pendent flowers, bracts petiolate, lamina ovate, up to 35 × 15 mm; pedicel 15–20 mm long; calyx densely setose, tube conical, 5 × 5 mm, calyx lobes 5, narrowly triangular-ovate, 13–15 × 3–4 mm near base, densely setose and covered with scabrid trichomes on the outside; corolla half spreading; petals narrowly oblong, cymbiform, 18–20 × 7–8 mm, apex acuminate, without triangular teeth, setose and sparsely set with scabrid and glochidiate hairs on back, densely set with gland-tipped, 3-celled uniseriate trichomes, especially along the margins, orange-red; nectar scales 5, with rectangular back, 8–9 × 3 mm, base incurved, basally on back with two indistinct, depressedly globose sacs 3 mm diam., yellow, scale neck not thickened, without appendages, laterally protracted into two incurved, horizontal wings 3 × 1 mm; staminodia 2 per scale, 11 mm long, base dilated, 1 mm wide, filiform above, base and tip curved, papillose, white; stamens numerous, in 5 epipetalous fascicles of 12 to 14 each; filaments 12–15 mm long, white, anthers 2 × 1.5 mm black. Fruit not seen.

Only known from the type collection.

Nasa stolonifera was in full flower when collected in October 2000, i.e., in the middle of the dry season. It probably flowers and fruits throughout the year in this permanently moist region.

This new species of *Nasa* has no clear close allies in the genus. It has well-developed underground stolons and forms large, clonal stands in the remnants of montane *Alnus* forests in the province of Bolívar. The presence of underground stolons is a very rare character in *Nasa* and otherwise found in *Nasa limata* (Killip) Weigend, which is generally considered a member of *Nasa* ser. *Grandiflorae* and differs in flower morphology and color (flowers dark orange and nectar scales dark crimson), indument, and leaf morphology. The dense trichome cover is remotely reminiscent of *Nasa urentivelutina*, which grows just on the other side of the Marañon river, but that species has different nectar scales and alternate leaf arrangement, and is a stiffly erect, nonstoloniferous shrub. Perhaps the closest relative of *N. stolonifera* is *N. driesslei* Weigend, which grows just a little bit further north (Province Chachapoyas) in a similar type of environment, but differs, e.g., in clear yellow flowers and a white central line on the leaf blade. The name "stolonifera" refers to the presence of underground stolons.

4. Nasa victorii Weigend, sp. nov. TYPE: Peru. Dept. San Martín: Prov. Huállaga, District Saposoa, between El Tambo and Jalca del Rayo, low cloud forest, 2500–3200 m, 15 Sep. 2000, *V. Quipuscoa S., S. Leiva G. & Y. Díaz 2480* (holotype, HUT; isotypes, BSB, F, HAO, HUSA, MO). Figures 1, 6.

Haec species *N. anderssonii* affinis, sed ab ea ovario basi trichomatibus urentibus instructo (nec omnino trichomatibus urentibus carente) et habitu fruticis scandentis (nec herbae rigide erectae), ab omnibus speciebus ceteris Loasacearum caule costis longitudinalibus elevatis instructo differt.

Erect to ascending shrub 0.6–2 m tall; stem terete with typically 6 elevated longitudinal ridges, with white pith, to 1.5 cm diam., with very few reddish brown setae 1–3 mm long and densely covered with minute scabrid hairs < 0.2 mm long, eglandular. Leaves opposite, petioles 40–65 mm long, very sparsely setose; lamina widely ovate, 100–150 × 60–90 mm, membranaceous, base subtruncate (sinus < 2 mm deep), apex long acuminate, margin lobed with 5 to 7 indistinct, triangular lobes on each side, each up to 5 × 15 mm, lobe margin serrate to serrate-denticulate; abaxial surface with scattered setae on veins and covered with numerous scabrid hairs (< 0.2 mm), adaxial sur-

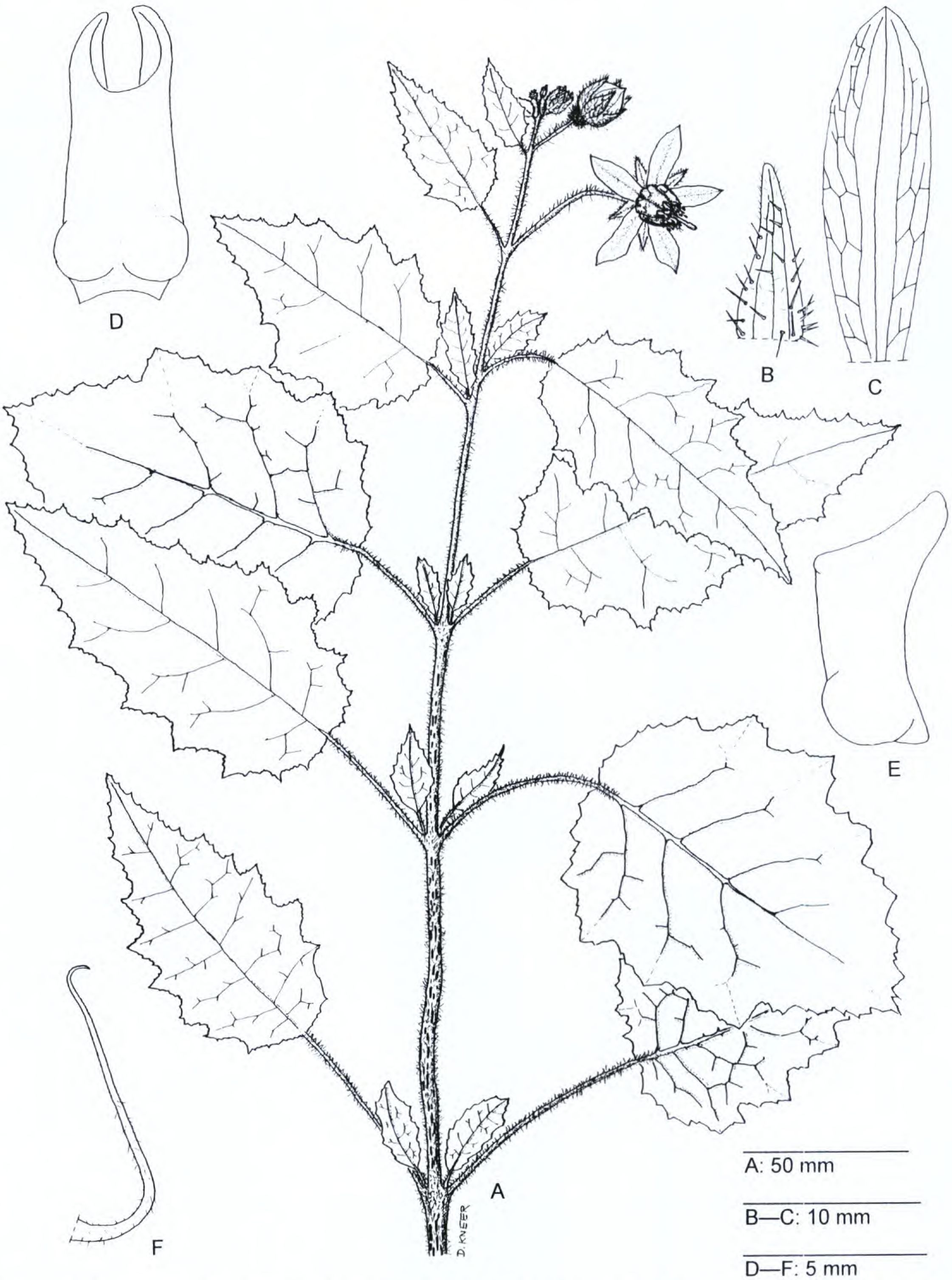

Figure 5. *Nasa stolonifera* Weigend. —A. Habit. —B. Sepal. —C. Petal. —D, E. Floral scale, dorsal and lateral view. —F. Staminode, lateral view. (Drawn from *Weigend et al. 2000/822*, BSB.)

Figure 6. *Nasa victorii* Weigend. —A. Habit. —B. Single flower. —C. Sepal. —D. Petal. —E. Floral scale, lateral view. —F. Staminode, dorsal view. (Drawn from *Quipuscoa et al. 2480*, BSB.)

face very sparsely setose on veins and densely covered with short scabrid hairs (< 0.3 mm); venation pinnate with 3 to 5 lateral veins on each side. Inflorescence a terminal monochasium 15–20 cm long, with up to 6 pendent flowers, bracts petiolate, lamina ovate, up to 55 × 20 mm; pedicel 20–40 mm long; calyx setose only at the base, tube subglobose, 5 × 5 mm, calyx lobes 5, narrowly triangular-ovate, ca. 10 × 3–4 mm, densely setose and densely covered with short scabrid trichomes on the outside; corolla widely campanulate; petals obovate, shallowly cymbiform, 15 × 11 mm, apex

rounded, without triangular teeth, esetulose and densely set with short scabrid hairs on back, eglandular, orange-red; nectar scales 5, with rectangular back, 8 × 3 mm, base incurved, basally on back with 2 indistinct, depressedly globose sacs 3 mm diam., yellow, scale neck not thickened, without appendages, laterally protracted into 2 incurved, horizontal wings 3 × 2 mm; staminodia 2 per scale, 13 mm long, base dilated, 1 mm wide, filiform above, base and tip curved, papillose, white; stamens numerous, in 5 epipetalous fascicles of 12 to 14 each; filaments 12–15 mm long, white, anthers 2 × 1.5 mm, black. Capsule subglobose, ca. 20 mm diam., with setae only in proximal part and covered with numerous very short, white, scabrid trichomes, opening with 3 apical valves. Seeds numerous, ovoidal, testa reticulate.

Nasa victorii probably flowers and fruits sporadically throughout the year, since its habitat does not experience a marked dry season. It has been collected with flower buds in September and with flowers and fruits in September.

While most species of *Nasa* are readily recognized, *N. victorii* is certainly one of the most readily identifiable taxa. Its stems with longitudinal ridges are unique not only in the species group, but in the entire family Loasaceae. The species is a subscandent to scandent shrub in dense, wet cloud forest on the eastern slope of the Andes, a notoriously poorly known region. Like *N. nubicolorum* from the same general region (Weigend, 2000a) it grows in deep leaf litter and humus in extremely wet habitats. The species is now known from two collections in the department San Martín, but may be more widespread in this inaccessible region. Like most species of the group it is likely to be sensitive to habitat alteration and therefore vanishes rapidly from areas as they become accessible to civilization.

Its sparse indument is reminiscent of *Nasa anderssonii*, which is known from the Cordillera Colán in Peru and also neighboring Ecuador, but it differs from that taxon, e.g., in stem and flower morphology, and habit. *Nasa victorii* is named in honor of Victor Quipuscoa Silvestre (HUSA, Arequipa, Peru).

Paratypes. PERU. **Dept. San Martín:** Prov. Rioja, road from Pedro Ruiz to Rioja, between La Esperanza and Nuevo Cajamarca, near km 377, 2000–2300 m, 05°42′09″S, 077°48′27″W, 21 Oct. 2000, *M. Weigend et al. 2000/929* (BSB, HUT, M, USM).

New Record

5. Nasa amaluzensis (Weigend) Weigend, Monogr. Syst. Bot. Missouri Bot. Gard. 75: 954. 1999. *Loasa amaluzensis* Weigend, Bot. Jahrb. Syst. 118: 264. 1996. TYPE: Ecuador. Loja: 26.4 km S of Amaluza on road to Zumba, river valley, 2800 m, *S. Clemants 2392* (holotype, QCA; isotype, QCNE). Figure 1 (see also Weigend, 2000b: fig. 16J–R).

Nasa amaluzensis apparently flowers during the wet season (January to April) and probably fruits from April onward, like most species of *Nasa* from the western part of the Andes.

Nasa amaluzensis was described from a single collection from the extreme south of Ecuador in 1996. Material exactly matching the type has now been collected by S. Leiva G. in the extreme north of Peru, so that this species is now known from both countries. *Nasa amaluzensis* shows clear affinity to *Nasa loxensis* from Ecuador (it shares horizontally inflexed wings on its nectar scales, and cymbiform, setose petals), but differs in distally densely glandular stems and pentagonous leaves with acute leaf lobes. Its closest geographical neighbors are *Nasa solata* (leaves ovate, petals linear), *N. sagasteguii* (similar leaf shape but with ovate leaf lobes, carnose, esetulose petals), and *N. glabra* (plant virtually esetulose, carnose, esetulose petals).

Material examined. ECUADOR. **Prov. Loja:** 26.4 km S of Amaluza on road to Zumba, river valley, 2800 m, *S. Clemants 2392* (QCA, QCNE). PERU. **Dept. Piura:** Prov. Ayavaca, Cerro Aypate, 2650 m, 10 Jan. 2002, *S. Leiva G. 2632* (BSB, F, HAO, HUT).

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Aconitum ouvrardianum var. *acutiusculum* (Ranunculaceae), a New Combination from Yunnan, China

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ABSTRACT. Close examination of the type specimens of *Aconitum acutiusculum* and of *A. acutiusculum* var. *aureopilosum* has shown that their inflorescence rachis and pedicels are all yellowish spreading pubescent, and thus the two taxa show no essential difference from each other. They are merged herein. A new combination, *A. ouvrardianum* var. *acutiusculum* (Fletcher & Lauener) Q. E. Yang & Y. Luo, is proposed, considering that *A. acutiusculum* is most similar to *A. ouvrardianum* in having leaves 3-sect with ultimate lobules linear or lanceolate-linear, inflorescence rachis and pedicels yellowish spreading puberulent, and the upper sepal navicular-galeate, yet distinguishable by the acute tip of the lateral sepals; they are sympatric in geographical distribution, both occurring in Dêqên County, northwestern Yunnan.

Key words: *Aconitum*, China, Ranunculaceae, Yunnan.

Fletcher and Lauener (1950: 198) described *Aconitum acutiusculum* based on *Forrest 14696* from Baima Shan, Dêqên County, northwestern Yunnan, and stated that this species is clearly distinguished from all others in the genus by the acute tip of the lateral sepals, an otherwise unimportant feature in the classification of *Aconitum* L. because the lateral sepals in this genus are generally subrounded in outline. In the original Latin description, the upper part of the stem and the inflorescence are mentioned as densely and extremely minutely white crispy pubescent (Caulis . . . praesertim superne cum inflorescentia dense et minutissime albo-crispo-pubescens). Wang (1965) described a new variety, *A. acutiusculum* var. *aureopilosum*, from Yangtsa, Dêqên County, and stated that this variety is distinguished from the typical one by having the inflorescence yellowish spreading puberulent. When describing this new variety, he had no opportunity to examine the type specimens of *A. acutiusculum* and thus had to base his judgment on Fletcher and Lauener's description (Wang, pers. comm.). We have checked the holotype and isotype of *A. acutiusculum* var. *aureopilosum* at PE and found that the inflorescence rachis and pedicels are indeed densely yellowish spreading puberulent. Pedicel pubescence is one of the most important diagnostic characters in the classification of the genus *Aconitum*.

Close examination of the type material of *Aconitum acutiusculum*, *Forrest 14696*, at BM, E, and K has shown that its inflorescence and pedicels, like those of *A. acutiusculum* var. *aureopilosum*, are densely yellowish spreading puberulent and that other important characters, such as the division of leaves and the shape of the upper sepal, are by no means different from those of *A. acutiusculum* var. *aureopilosum*. Their leaves are 3-sect with ultimate lobules linear or lanceolate-linear, and the upper sepal is navicular-galeate. As this variety shows no essential difference from *A. acutiusculum* in all the characters, they should be merged.

Aconitum ouvrardianum Handel-Mazzetti (1931) is a common species in Dêqên, northwestern Yunnan. We have not seen its type, *Handel-Mazzetti 9702*, but fortunately this species is quite richly represented in the two major Chinese herbaria, PE and KUN, and its identity has long been determined with certainty. This species shows no essential difference from *A. acutiusculum* in all the characters except in the shape of the lateral sepals, with those in *A. acutiusculum* being acute at the apex while those in *A. ouvrardianum* are subrounded. In our herbarium observations we found this feature is quite constant in these two entities, but this difference is too tenuous to allow treating them as two independent species. In fact, the type specimen of *A. acutiusculum* var. *aureopilosum* at PE was once referred to *A. ouvrardianum* by Chen and Liu (1941). When Handel-Mazzetti (1931) described *A. ouvrardianum*, he had noticed the similarity of *Forrest 14696* with his new species but also their differences, particularly in the shape of the lateral sepals. Thus, he did not refer this specimen to any species then known to him. Considering the consistent difference in the shape of the lateral sepals

yet the great similarity in other characters between *A. ouvrardianum* and *A. acutiusculum*, as well as their sympatric distribution, it seems best to reduce *A. acutiusculum* as a variety under *A. ouvrardianum*. The following new combination is thus proposed.

Aconitum ouvrardianum Handel-Mazzetti var. **acutiusculum** (Fletcher & Lauener) Q. E. Yang & Y. Luo, comb. nov. Basionym: *Aconitum acutiusculum* Fletcher & Lauener, Notes Roy. Bot. Gard. Edinburgh 20: 198. 1950. TYPE: China. Yunnan: Dêqên County, Baima Shan, heavy pasture on the margins of pine forests, 12,000 ft., Aug. 1917, *G. Forrest 14696* (holotype, E; isotypes, K, BM).

Aconitum acutiusculum var. *aureopilosum* W. T. Wang, Acta Phytotax. Sin., addit. 1: 85. 1965. Syn. nov. TYPE: China. Yunnan: Dêqên County, Yangtsa, Snow Range, Rusala, mountain grassy slope, 4100 m, Aug. 1937, *T. T. Yu 9671* (holotype, PE; isotype, PE).

Aconitum ouvrardianum var. *acutiusculum* is only known from Dêqên County, northwestern Yunnan, and seems quite uncommon. Although we had made several botanical expeditions to this area, we failed to find it. The typical variety *ouvrardianum*, however, is very common in this area, growing in alpine meadows or bushes at altitudes from 3000 to 4100 m.

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Miscellaneous Notes on Pteridophytes from China and Neighboring Regions (IV)—Validation of Some Combinations in *Diplopterygium* (Pteridophyta: Gleicheniaceae)

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ABSTRACT. Some names of *Diplopterygium* widely used in Chinese literature of pteridophytes are not valid; therefore, formal combinations of five names for *Diplopterygium* species from China are validated, i.e., *D. criticum* (Ching & P. S. Chiu) Ching ex X. C. Zhang, *D. rufum* (Ching) Ching ex X. C. Zhang, *D. rufopilosum* (Ching & P. S. Chiu) Ching ex X. C. Zhang, *D. simulans* (Ching) Ching ex X. C. Zhang, and *D. yunnanense* (Ching) Ching ex X. C. Zhang. *Diplopterygium rufopilosum* is lectotypified.

Key words: China, *Diplopterygium*, Gleicheniaceae, Pteridophyta.

Diplopterygium (Diels) Nakai was traditionally treated as a subgenus of *Gleichenia* Smith (Holttum, 1957, 1959; Tagawa & Iwatsuki, 1979; Tryon & Tryon, 1982), but is now generally accepted as a separate genus (Ching, 1978; Kramer, 1990; Wu & Ching, 1991; Østergaard Andersen & Øllgaard, 2001). The Chinese species of *Diplopterygium* were recorded under the generic name *Hicriopteris* C. Presl (Ching, 1940; Ching et al., 1959). Holttum (1959) discussed the reason why *Hicriopteris* was misused in this sense. The type of *Hicriopteris* was first described as a species of *Dicranopteris* Bernhardi, i.e., *D. speciosa* (C. Presl) Holttum. When Presl (1851) described the genus he compared it with *Gleichenia glauca* (Thunberg) Hooker, a species of *Diplopterygium*. Later authors (Ching, 1940; Copeland, 1947; Ching et al., 1959) thought he was describing a species of *Gleichenia* sect. *Diplopterygium* and consequently misapplied the generic name *Hicriopteris*. *Hicriopteris* is properly a synonym of *Dicranopteris* (see Holttum, 1959; Østergaard Andersen & Øllgaard, 2001).

Three genera of the fern family Gleicheniaceae occur in China: *Diplopterygium* (Diels) Nakai, *Sticherus* C. Presl, and *Dicranopteris* Bernhardi. Plants of *Diplopterygium* can be easily distinguished from those of *Sticherus* by their bipinnate or pinnate-pinnatifid branches, and from *Dicranopteris* by their dormant buds and rhizomes with scales, veinlets of segments once forked, and sporangia (2)3 to 5(7) per sorus; in *Dicranopteris* the dormant buds and rhizomes with hairs, veinlets of segments 2 to 4 times forked, and sporangia ca. 8 to 25 per sorus (Østergaard Andersen & Øllgaard, 2001) separate it from both *Diplopterygium* and *Sticherus*.

Diplopterygium (Diels) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 47. 1950. *Gleichenia* sect. *Diplopterygium* Diels, in Engler & Prantl, Nat. Pflanzenfam. 1(4): 353. 1900. *Dicranopteris* sect. *Diplopterygium* (Diels) Underwood, Bull. Torrey Bot. Club 34: 251. 1907. *Gleichenia* subg. *Diplopterygium* Holttum. Reinwardtia 4: 261. 1957. TYPE: *Diplopterygium glaucum* (Thunberg ex Houttuyn) Nakai (*Polypodium glaucum* Thunberg ex Houttuyn).

Diplopterygium contains about 25 species, from Asia to Queensland, Australia, and Polynesia (including Hawaii), mainly in tropical Asia, not in Africa. A single species, *D. bancroftii* (Hooker) A. R. Smith, occurs in tropical America.

Ching et al. (1959) recorded 16 species of *Diplopterygium* under the generic name *Hicriopteris* from China and one from northern Vietnam, the region bordering China. Six of these already have been transferred into *Diplopterygium*, including:

Diplopterygium blotianum (C. Christensen) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 49. 1950.

Diplopterygium cantonense (Ching) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 49. 1950.

Diplopterygium chinense (Rosenstock) De Vol, in H. L. Li et al., Fl. Taiwan 1: 92. 1975, "*chinensis*."

Diplopterygium giganteum (Wallich ex Hooker) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 50. 1950.

Diplopterygium glaucum (Thunberg ex Hout-

tuyn) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 51. 1950.

Diplopterygium laevissimum (H. Christ) Nakai, Bull. Nat. Sci. Mus. Tokyo 29: 52. 1950.

Ching (in Shing, 1982) published numerous combinations for Chinese species of *Diplopterygium*, but these were not validated properly according to Article 33.3 of the ICBN (Greuter et al., 2000). Two of these were validated later, i.e., *Diplopterygium maximum* Ching & H. S. Kung (in Kung, 1988: 134), and *Diplopterygium glaucoides* (Ching) Ching ex P. S. Wang & X. Y. Wang (in Wang & Wang, 2001: 279). Some of them are presently regarded as synonyms of various species and therefore need not be transferred into *Diplopterygium*.

The following five combinations for *Diplopterygium* are formally proposed here in order to solve the nomenclatural problems of these Chinese species and for the revision of fern flora of China.

Diplopterygium criticum (Ching & P. S. Chiu) Ching ex X. C. Zhang, comb. nov. Basionym: *Hicriopteris critica* Ching & P. S. Chiu, in S. S. Chien & Chun, Fl. Reipubl. Popul. Sin. 2: 348. 1959. *Diplopterygium criticum* (Ching & P. S. Chiu) Ching, in K. H. Shing, Gloss. Term. Nam. Ferns 50. 1982, nom. inval. TYPE: China. Yunnan: Pingbian, Dawei Shan, *R. C. Ching 55* (holotype, PE).

Diplopterygium rufum (Ching) Ching ex X. C. Zhang, comb. nov. Basionym: *Hicriopteris rufa* Ching, in S. S. Chien & Chun, Fl. Reipubl. Popul. Sin. 2: 347. 1959. *Diplopterygium rufum* (Ching) Ching, in K. H. Shing, Gloss. Term. Nam. Ferns 50. 1982. nom. inval. TYPE: China. Yunnan: Pingbina, Dawei Shan, *K. M. Feng 4832* (holotype, PE).

The collection number was misprinted as 4823 when the species was published, but on the label of the type in PE the number is 4832.

Diplopterygium rufopilosum (Ching & P. S. Chiu) Ching ex X. C. Zhang, comb. nov. Basionym: *Hicriopteris rufopilosa* Ching & P. S. Chiu, in S. S. Chien & Chun, Fl. Reipubl. Popul. Sin. 2: 348. 1959, "*rufo-pilosa*." *Diplopterygium rufopilosum* (Ching & P. S. Chiu) Ching, in K. H. Shing, Gloss. Term. Nam. Ferns 50. 1982, "*refo-pilosum*," nom. inval. TYPE: China. Yunnan: Dali, Cang Shan, *C. Y. Wu 11825* (lectotype, designated here, PE).

A second syntype, *H. C. Wang 3541* (PE), is of a young sterile plant, but *C. Y. Wu 11825* is a fertile plant; therefore, it is selected as the lectotype.

Diplopterygium simulans (Ching) Ching ex X. C. Zhang, comb. nov. Basionym: *Hicriopteris simulans* Ching, Acta Phytotax. Sin. 8: 133, 161. 1959. *Diplopterygium simulans* (Ching) Ching, in K. H. Shing, Gloss. Term. Nam. Ferns 50. 1982, nom. inval. TYPE: China. Hainan: *C. Wang 35496* (holotype, PE).

Diplopterygium yunnanense (Ching) Ching ex X. C. Zhang, comb. nov. Basionym: *Hicriopteris yunnanensis* Ching, in S. S. Chien & Chun, Fl. Reipubl. Popul. Sin. 2: 350. 1959. *Diplopterygium yunnanense* (Ching) Ching, in K. H. Shing, Gloss. Term. Nam. Ferns 50. 1982, nom. inval. TYPE: China. Yunnan: Jingdong, Wuliang Shan, *W. H. Hsu 6* (holotype, PE).

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Novelties and Notes on Miscellaneous Asian Brassicaceae

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ABSTRACT. *Draba bartholomewii* (Brassicaceae), a new species from Qinghai, China, is described and illustrated. The monotypic genera *Coelonema* and *Nesocrambe* are reduced to the synonymy of *Draba* and *Hemicrambe*, respectively. The new combinations *Alyssum dahuricum*, *Draba draboides*, *Hemicrambe socotrana*, *Lepidium coronopus*, and *Pegaeophyton purii* are proposed.

Key words: *Alyssum*, Asia, Brassicaceae, *Coelonema*, *Dilophia*, *Draba*, *Hemicrambe*, *Lepidium*, *Nesocrambe*, *Pegaeophyton*, *Ptilotrichum*.

Delimitation of genera of Brassicaceae (Cruciferae) is a well-known problem, and 125 of the 337 genera recognized by Appel and Al-Shehbaz (2003) are monotypic, with about an additional 100 containing two to four species (oligotypic). Molecular studies (see review by Koch et al., 2003) have clearly demonstrated that the vast majority of monotypic genera are indistinguishable from and nested within larger genera. Upon a critical re-evaluation of morphology, two monotypic genera, *Coelonema* Maximowicz and *Nesocrambe* A. G. Miller, are reduced herein to synonymy of other genera well established on the basis of morphological and molecular grounds (Koch & Al-Shehbaz, 2002; Koch et al., 2003; Warwick & Black, 1997; Gómez-Campo, 1999).

The present paper deals with the description of a new species of *Draba*, as well as nomenclatural adjustments in the genera *Alyssum* L., *Draba* L., *Hemicrambe* Webb, *Lepidium* L., and *Pegaeophyton* Hayek & Handel-Mazzetti.

Alyssum versus *Ptilotrichum*

Although most authors place *Ptilotrichum* C. A. Meyer in the synonymy of *Alyssum* (e.g., Dudley, 1964; Ball & Dudley, 1993; Zhou et al., 2001; Appel & Al-Shehbaz, 2003), a few others (e.g., Rebenskaya, 1994; Czerepanov, 1995) maintain both genera. As indicated by Zhou et al. (2001), the characters used to distinguish *Ptilotrichum* from *Alyssum* (e.g., white vs. yellow flowers, edentate vs. dentate filaments, and 1-seeded vs. 2- or 3-seeded locules) are unreliable and found within *Alyssum* excluding *Ptilotrichum*. Therefore, these alleged generic boundaries are artificial, and the two genera should be united. All except one of the species originally described in *Ptilotrichum* have names in *Alyssum*. The following new combination is needed.

Alyssum dahuricum (Peschkova) Al-Shehbaz, comb. nov. Basionym: *Ptilotrichum dahuricum* Peschkova, Novosti Sist. Vyssh. Rast. 15: 230. 1979. TYPE: Russia. Chita: Onon River system, mountain at Bukukun River, near Bukukunskij, 18 July 1913, *V. Smirnov 1986* (holotype, LE).

Alyssum dahuricum is easily distinguished at anthesis from the closely related *A. tenuifolium* Stephan ex Willdenow by having stramineous stems and by lacking the basal and lowermost cauline leaves. By contrast, *A. tenuifolium* has purplish or greenish stems and persistent basal rosette and cauline leaves.

Draba versus *Coelonema*

The monotypic *Coelonema* was recognized in various Chinese floras (e.g., Zhou et al., 2001) as endemic and was said to differ from *Draba* solely by including stoloniferous perennials with flattened

bases of staminal filaments. *Draba* was said to consist of annuals, biennials, or perennials with slender or slightly flattened staminal filaments. A critical examination at LE of the type of *C. draboides* Maximowicz, as well as numerous other species of Asian *Draba*, reveals that these alleged differences are insignificant because several species of *Draba* (e.g., *D. sibirica* (Pallas) Thellung) are typically stoloniferous, and the filament bases vary in this complex genus of ca. 350 species from slender to distinctly flattened. Therefore, the conclusion reached by Appel and Al-Shehbaz (2003) in uniting *Coelonema* with *Draba* is justified, and the following new combination is needed to accommodate *C. draboides* in *Draba*.

Draba draboides (Maximowicz) Al-Shehbaz, comb. nov. Basionym: *Coelonema draboides* Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 26: 424. 1880. TYPE: China. [Gansu]: "Terra Tangutorum. Jugum S a fl. Tetung ad declivitates denudates mintium rarius, 30 April–12 May 1873," *N. M. Prezewalski 14* (holotype, LE).

Draba

During a visit to LE in 2002, I examined the four syntypes of *Draba eriopoda* Turczaninow, a species widely distributed in Bhutan, China, India, Mongolia, Nepal, and Russia. It became immediately evident that the treatment of *D. eriopoda* in Zhou et al. (2001) represented two distinct species, of which one is described below as new.

Draba bartholomewii Al-Shehbaz, sp. nov. TYPE: China. Qinghai: Dari (Darlag) Xian, just N of Manzhang, along Manzhang He, betw. Dari & Banma (Baima), at base of valley sides in loose soil, 4000 m, 33°17′51″N, 100°25′55″E, 12 Aug. 1993, *Ho Tingnung, Bruce Bartholomew & Michael G. Gilbert 1185* (holotype, MO; isotypes, BM, CAS, E, GH, HNWP, PE). Figure 1.

Herba annua. Caules decumbentes, ad basim ramosi, pilis stellatis praediti. Folia basalia nulla; folia caulina 2–6(–10), sessilia, nonauriculata, ovata vel elliptica, 1–3.5 × 0.4–1.5 cm, subtus pilis subsessilibus stellatis 4-radiatis praedita, supra pilis subsetosis simplicibus et stipitato-furcatis praedita. Racemi 8–20-flori, rhachidibus rectis. Pedicelli fructiferi horizontales, 5–15 mm longi. Petala flava, spathulata, 1.2–1.6 × 0.5–0.6 mm. Ovarium 14–20-ovulatum. Fructus oblongi, 8–10(–12) × (2.5–)3–3.5 mm, compressi, pilis simplicibus et subsessilibus furcatis praediti. Semina 1–1.3 × 0.7–0.9 mm.

Herbs annual, 5–25 cm tall; stems decumbent, branched primarily at or near base, pubescent with subsessile stellate trichomes rarely mixed with simple ones, rarely glabrous distally. Basal leaves withered by anthesis; cauline leaves 2 to 6(to 10), sessile, not auriculate; leaf blade ovate to elliptic, 1–3.5 × 0.4–1.5 cm, abaxially pubescent with subsessile or short-stalked, 4-rayed, stellate trichomes with simple rays, adaxially with subsetose simple or long-stalked forked trichomes sometimes mixed with fewer, smaller, 4-rayed stellate ones, base cuneate, margin 3- to 5-toothed on each side, apex acute. Racemes 8- to 20-flowered, ebracteate, elongated in fruit; rachis straight; fruiting pedicels 5–15 mm long, horizontal, straight, pubescent all around, or rarely glabrescent. Sepals oblong, 1–1.3 × 0.6–0.8 mm, erect, abaxially pilose with stellate trichomes, base of lateral pair not saccate, margin membranous; petals yellow, spatulate, 1.2–1.6 × 0.5–0.6 mm, apex retuse, obscurely clawed at base; filaments 0.8–1 mm; anthers ovate, 0.1–0.2 mm; ovules 14 to 20 per ovary. Fruit oblong, 8–10(–12) × (2.5–)3–3.5 mm, often horizontal, latiseptate, not twisted; valves sparsely puberulent with simple and subsessile forked trichomes, rarely glabrescent, obscurely veined, base and apex acute; style obsolete, rarely to 0.1 mm; seeds brown, ovate, 1–1.3 × 0.7–0.9 mm. Flowering and fruiting in August.

The new species is named after Bruce Bartholomew, one of the collectors of the type collection.

Draba bartholomewii is easily distinguished from *D. eriopoda* by having decumbent stems, horizontal fruiting pedicels pubescent all around or rarely glabrous, pilose sepals with stellate trichomes, small petals 1.2–1.6 × 0.5–0.6 mm, oblong, often horizontal fruits (2.5–)3–3.5 mm wide, and fruit valves puberulent with simple and subsessile forked trichomes. By contrast, *D. eriopoda* has erect stems, divaricate-ascending fruiting pedicels often glabrous adaxially and pubescent abaxially, pilose sepals with simple trichomes, larger petals 2–3(–3.5) × (0.5–)0.8–1 mm, erect or ascending, ovate or ovate-elliptic fruits 1.5–2.5 mm wide, and glabrous fruit valves.

Draba bartholomewii is also related to *D. alticola* Komarov (Afghanistan, China, Kyrgyzstan, Tajikistan), which it resembles in flower size and fruit shape. However, the latter has rosulate basal leaves, leafless stems, a flexuous rachis in fruiting racemes, pilose sepals with simple and forked trichomes, glabrous fruits 1–2 mm wide, and seeds 0.4–0.5 mm long. *Draba bartholomewii* lacks the basal leaf rosette and has 2 to 6(to 10) cauline leaves, a straight rachis in fruiting racemes, pilose

Figure 1. *Draba bartholomewii* Al-Shehbaz. —A. Plant. —B. Trichomes of abaxial leaf surface. —C. Trichomes of adaxial leaf surface. —D. Petal. Scales: A = 1 cm; B, C = 0.2 mm; D = 0.5 mm. Drawn by Al-Shehbaz from the holotype, *Ho, Bartholomew & Gilbert 1185* (MO).

sepals with stellate trichomes, puberulent fruits (2.5–)3–3.5 mm wide, and seeds 0.7–0.9 mm long.

Paratypes. CHINA. **Qinghai:** Nangqen Xian, Xiaolong Gou, W of Nangqen on road to Domba, 32°17′N, 96°16′E, *T. N. Ho, B. Bartholomew, M. Watson & M. G. Gilbert 2822* (CAS, HNWP, MO); Tungjen Xian, *T. P. Wang 6186* (PE). **Sichuan:** Haitzeshan, *H. Smith 11598* (MO, TI, UPS).

Hemicrambe versus *Nesocrambe*

Hemicrambe consists of two species, of which one, *H. fruticulosa* Webb, is endemic to Morocco and the other, *H. fruticosa* (C. C. Townsend) Gómez-Campo, is endemic to the island Soqotra (Yemen). The two species are subshrubs disjunctly separated by some 6900 km (Gómez-Campo, 1977, 1978; Townsend, 1971). The genus is characterized by having yellow or white flowers, petiolate and dentate or lyrate-pinnatipartite leaves, patent median nectaries, reflexed fruiting pedicels, and segmented, flattened fruits with a 2- to 4-seeded, indehiscent distal segment and a seedless or 1-seeded, dehiscent proximal segment (Appel & Al-Shehbaz, 2003).

The recently described *Nesocrambe* (Miller et al., 2002) is indistinguishable from *Hemicrambe* in almost every morphological aspect. It is said to be a perennial herb with a woody base instead of a subshrub, but this is an unreliable distinction. Both genera have well-developed, patent, median nectar glands, a feature unique in the entire tribe Brassiceae (Townsend, 1971; Gómez-Campo, 1977; Miller et al., 2002). Miller et al. (2002) did not include *Nesocrambe socotrana* A. G. Miller in *Hemicrambe* because when they compared it with the Soqotran *H. fruticosa* they found that *H. fruticosa* has white instead of yellow flowers, dentate instead of lyrate-pinnatisect leaves, and cylindric instead of flattened fruits. The Moroccan *H. fruticulosa* has both yellow flowers and lyrate-pinnatipartite leaves. The only other difference between the two genera is that in *Hemicrambe* the distal fruit segment is compressed and the proximal segment is sometimes seedless, whereas in *Nesocrambe* the distal fruit segment is cylindric and the proximal segment is 1-seeded. However, such highly artificial separation is good only at the species rather than the generic level. Miller et al. (2002: 62) have indicated that *Nesocrambe* "is clearly related to *Hemicrambe*." In my opinion, the remarkable similarities in nectar gland and almost every aspect of the plant (see table 1 in Miller et al., 2002: 63) strongly argue for the maintenance of one genus. Furthermore, there is no need to create a new monotypic genus when its nearest relatives, species of *Hemicrambe*, are known. Several other genera of the tribe Brassiceae (e.g., *Conicya* Porta & Rigor ex Roy, *Vella* L.) show fruit diversity far greater than in *Hemicrambe* including *Nesocrambe* (Leadlay & Heywood, 1990; Warwick & Al-Shehbaz, 1998).

Miller et al. (2002: 66) stated that "the perennial habit is relatively uncommon in the Brassicaceae." However, Al-Shehbaz (1984: 349) indicated that "more than 62 percent [of the family] are perennials" and only about 5% are typically woody.

Key to the Species of *Hemicrambe*

1a. Leaves crenate-dentate; flowers white; Soqotra . . . . . *H. fruticosa*
1b. Leaves lyrate-pinnatisect or lyrate-pinnatipartite; flowers yellow.
  2a. Perennial herbs woody only at base; fruits cylindric; Soqotra . . . . . *H. socotrana*
  2b. Subshrubs; fruits flattened; Morocco . . . . . *H. fruticulosa*

Hemicrambe socotrana (A. G. Miller) Al-Shehbaz, comb. nov. Basionym: *Nesocrambe socotrana* A. G. Miller, in Miller et al., Willdenowia 32: 63. 2002. TYPE: Republic of Yemen. Western Soqotra, Sharahin, 12°31′N, 53°20′E, 450 m, 6 Feb. 2001, *A. G. Miller, R. Atkinson, A. W. Kulaidi & N. Taleeb M-20021* (holotype, E; isotypes, B not seen, UPS not seen).

Lepidium

Based on extensive molecular studies (Brüggemann, 2000) and critical evaluation of morphology (Appel & Al-Shehbaz, 2003; Al-Shehbaz et al., 2002), *Coronopus* Zinn was reduced to the synonymy of *Lepidium*. All except one species of *Coronopus* have correct names in *Lepidium*. The exception is *C. squamatus* (Forsskål) Ascherson, a species originally described in *Lepidium* by Forsskål (1775). However, the earliest validly published name for the species is *Cochlearia coronopus* L. (Linnaeus, 1753), and this specific epithet should be used in *Lepidium* when this genus is united with *Coronopus*. Therefore, the following new combination is needed.

Lepidium coronopus (L.) Al-Shehbaz, comb. nov. Basionym: *Cochlearia coronopus* L., Sp. Pl. 2: 648. 1753. TYPE: (lectotype, designated by Jonsell & Jarvis, 2002: 68) Herb. Linn. 826.5 (LINN).

Pegaeophyton versus *Dilophia*

Rawat et al. (1996) described the new species *Dilophia purii* from Garhwal in Northwest India.

The excellent illustration immediately suggested a possible affinity to *Pegaeophyton*. However, the description and illustration indicated the presence of glandular trichomes, a feature not known in any species of *Pegaeophyton* and *Dilophia* Thomson. When I examined the MO isotype of *D. purii*, I found none of the trichomes were glandular, and the generic affinity of this plant to *Pegaeophyton* became abundantly clear. *Pegaeophyton* differs from *Dilophia* by having accumbent instead of incumbent cotyledons, nonfleshy instead of fleshy fusiform roots, obtuse instead of strongly apiculate anthers, and smooth instead of apically cristate fruits.

Pegaeophyton purii (D. S. Rawat, L. R. Dangwal & R. D. Gaur) Al-Shehbaz, comb. nov. Basionym: *Dilophia purii* D. S. Rawat, L. R. Dangwal & R. D. Gaur, J. Bombay Nat. Hist. Soc. 93: 262. 1996. TYPE: India. Northwest Himalaya, Roopkund, 4850 m, 11 Aug. 1993, *D. S. Rawat s.n.* (holotype, GUH 22,498 not seen; isotype, MO).

Except for having flattened instead of terete and 8- instead of 2- to 4-seeded fruits, *Pegaeophyton purii* is quite similar in all aspects of leaves and flowers to *P. nepalense* Al-Shehbaz, Arai & H. Ohba, a species originally thought to be endemic to Nepal (Al-Shehbaz et al., 1998) but later reported from Bhutan, China, and India (Al-Shehbaz, 2000). The collection of mature fruiting material of *P. purii* should help in the determination of whether or not the two species are conspecific.

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Psychotria carrascoana (Rubiaceae), a New Species from the *Carrasco* Vegetation of Northeastern Brazil

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Abstract. *Psychotria carrascoana* (Rubiaceae, Psychotrieae) is here described and illustrated. It is endemic to *carrasco* vegetation, a closed, shrubby, xerophilous vegetation on quartzitic sand soils, on the plateaus of the Serra da Ibiapaba and Serra do Araripe, at altitudes of 800 to 900 m, state of Ceará, Brazil. Because of its reduced, triangular stipules, leaves drying pale green, commonly solitary flowers, and dorsally tricostate pyrenes, this species is placed in *Psychotria* subg. *Heteropsychotria*.

Key words: *carrasco*, Ceará, northeastern Brazil, *Psychotria*, Psychotrieae, Rubiaceae, shrubland.

As part of the project *Rubiaceae do Estado do Ceará*, in northeastern Brazil, fieldwork was conducted during 1998–2000, which has produced about 400 collections of species of this family. A preliminary checklist of the Rubiaceae of Ceará was recently presented (Delprete et al., 2001), and an annotated checklist will be published in the near future (Delprete & Souza, in prep.). Two new species of Rubiaceae were recently described from the arid vegetation of this state (*Simira gardneriana* Barbosa & Peixoto (2000); *Mitracarpus longicalyx* Souza & Sales (2001)), and the identity of some other taxa collected during this project is currently under study. Among these, a species of *Psychotria* restricted to *carrasco* vegetation, and readily distinguishable by its small leaves drying pale green, triangular stipules, flowers commonly solitary, and dorsally tricostate pyrenes, is described below.

Ecological Observations About *Carrasco* Vegetation

The definition of *carrasco* vegetation has long been debated, as it is not readily distinguishable from that of *caatinga*, the widespread xerophilous vegetation of northeastern Brazil. *Caatinga* is commonly characterized by two vegetational layers: sparse to moderately dense trees and shrubs frequently armed with thorns and almost completely leafless during the dry season, and the lower layer with the presence of Bromeliaceae and Cactaceae, and annual herbs (Rizzini, 1997). Andrade-Lima (1978) stated that *carrasco* vegetation is physiognomically distinct from *caatinga* vegetation because of the high density of shrubs and treelets, single-layered vegetation, and the almost complete absence of Cactaceae and Bromeliaceae. Rizzini (1997) and Fernandes (1981) recognized *carrasco* vegetation as sufficiently distinct from *caatinga* vegetation. Fernandes (1990) and Fernandes and Bezerra (1990) postulated two possible hypotheses about the identity and origin of *carrasco* vegetation: either as a distinct natural vegetation, or as a result of partial degradation of the *cerradão* vegetation, which gives the general aspect of a dense *capoeira* (secondary vegetation that can be originated from the degradation of several possible vegetation types). *Cerradão* is usually characterized by three vegetational layers: a tree layer 8–12(–18) m tall, with closed canopy and almost completely devoid of epiphytes; an intermediate arbustive layer about 3–5 m tall and with sparse shrubs and rare lianas; and a lower herbaceous layer, composed primarily of Cyperaceae, Poaceae, and Bromeliaceae (cf. Rizzini, 1997).

Araújo et al. (1998a, 1998b), in a project focused on the plant community and floristic composition of *carrasco*, studied three plots in the southern portion of the Planalto da Ibiapaba, near Novo Oriente, Ceará, Brazil. As a result of that study, only 31 out of 102 shrubby and arboreal species were found to

be exclusive to *carrasco*, while the other species were shared with the contiguous vegetation types. Those data alone confirmed the difficulty of deciding if *carrasco* vegetation should be treated as a degraded *cerradão* or a distinct vegetation type. After a series of additional studies, Araújo and Martins (1999) and Araújo et al. (1999) recently concluded that *carrasco* vegetation can be defined as a deciduous, dense, single-layered shrubland, with vines, irregular canopy, and sparse trees, with an average annual precipitation of 668–1289 mm, a dry season ranging from 5 to 7 months a year, growing on deep, acidic, distrofic quartzitic sands, at 700–900 m elevation. According to those authors, *carrasco* vegetation occurs within the semi-arid domain of northeastern Brazil, at the Chapada do Araripe, southern Ceará, and Planalto da Ibiapaba, at the border area of the states of Ceará and Piauí. The new species of *Psychotria* described below is endemic to this vegetation (hence the specific epithet), and it grows in the shade of shrubs and treelets.

Psychotria carrascoana Delprete & E. B. Souza, sp. nov. TYPE: Brazil. Ceará: Planalto da Ibiapaba, Mun. Ubajara, Jaburuna Sul, 830 m, 5 Jan. 1995 (fl), *F. S. Araújo 1054* (holotype, EAC; isotype, NY). Figure 1.

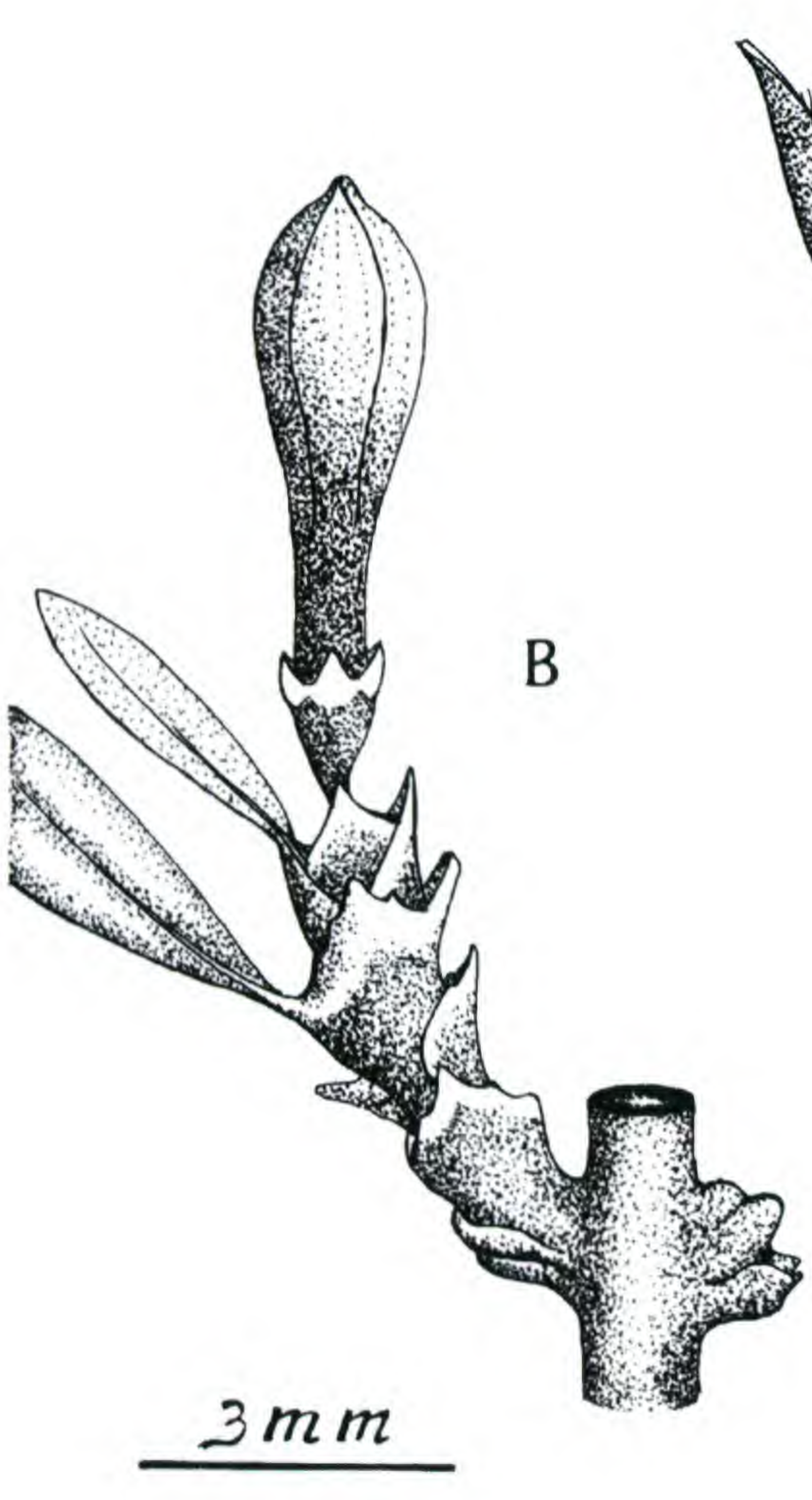
Haec species, suffrutex usque ad 1.3 m altus, quoad inflorescentiam terminalem subsessilem paucifloram *P. subtriflorae* similis, sed ab ea stipulis triangularibus (nec bilobis), inflorescentia ebracteata (nec bracteis naviculiformibus subtenta), tubo corollae 1.7–2.8 mm (nec 6–7 mm) longo atque fructibus rubris (nec cyano-purpureis) diversa.

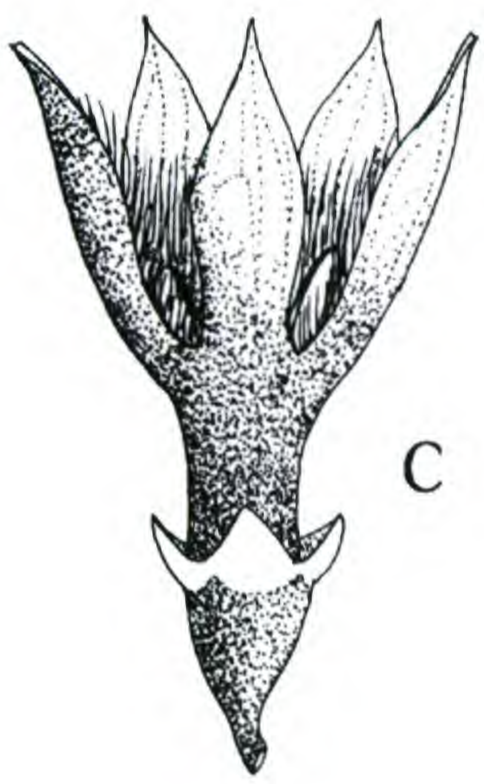
Subshrub 0.4–1.3 m tall, densely branched from the base; main stems often tortuous; bark thin, creamy white; *raphides* present in all plant parts. *Stipules* free at base, triangular, 1–2 × 0.8–2 mm, margin entire or sometimes denticulate, apex acute, glabrous outside, pubescent inside; *leaves* opposite, sessile to subpetiolate; petioles to 1.5 mm long; blades 9–30 × 2–9 mm, linear, narrowly elliptic to lanceolate, base attenuate, apex acute to obtuse, margins narrowly revolute, chartaceous, glabrous throughout, pale green; midvein prominent below, discolorous; secondary veins 5 to 9 each side, embedded within the lamina; domatia absent. *Inflorescence* uniflorous (rarely biflorous), terminal, on lateral short-shoots of 5 to 7 reduced nodes. *Flowers* subsessile to short-pedicellate; pedicels to 1.3 mm long; *hypanthium* broadly turbinate, ca. 2 × 1.2 mm, glabrous; *calyx* shallowly cupular; tube 0.2–0.3 mm long; calyx lobes 5(6), 0.3–0.5 mm long, deltoid to narrowly triangular, acute; *corolla* narrowly infundibuliform, 4.5–6.5 mm long, glabrous outside, with a ring of hairs from stamen insertion to mouth inside; corolla tube 1.7–2.8 mm long; corolla lobes 5 (rarely 6), 2.5–3.8 × 1.4–1.7 mm, oblong-ovate, acute and slightly thickened at apex, antrorse pubescent at basal portion inside; *stamens* subsessile, partially exserted; filaments 0.2–0.5 mm long, glabrous; anthers oblong, 0.7–0.9 × 0.3–0.5 mm; *disk* entire; *style* terete, 4–6 mm long; style branches spatulate, 0.5–0.7 × 0.3–0.4 mm. *Fruits* drupaceous, ovoid to ellipsoid, 3–5 × 3–4 mm, red; *pyrenes* plano-convex, dorsally 3-costate; *seeds* suborbicular, ca. 2.5 × 2 mm, pale brown; exotesta smooth.

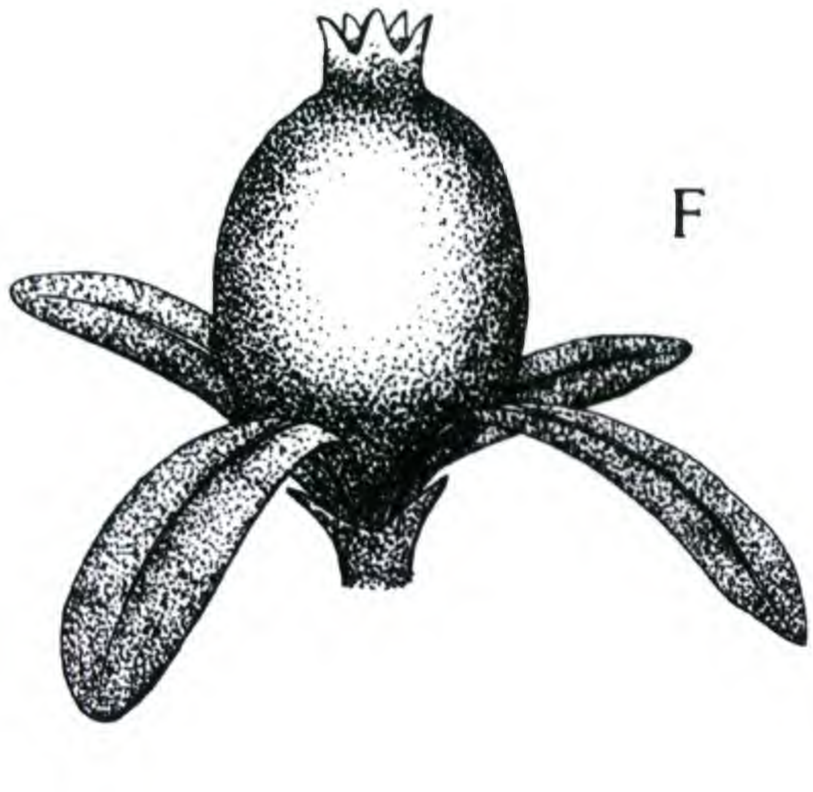
Distribution, habitat, and phenology. Endemic to the *carrasco* vegetation of the Planalto da Ibiapaba and Chapada do Araripe, state of Ceará, and probably occurring in the same vegetation type in the contiguous state of Piauí, always observed and collected in the shade of taller shrubs, at 800–900 m elevation. Flowering specimens were collected in January, and fruiting specimens in March and September.

Paratypes. BRAZIL. **Ceará:** Planalto da Ibiapaba, Mun. Ubajara, Jaburuna Sul, 830 m, 27 Apr. 1994 (st), *F. S. Araújo 679* (EAC), 23 May 1994 (st), *768* (EAC); Planalto da Ibiapaba, Mun. Novo Oriente, Baixa Fria, 16 Feb. 1991 (st), *F. S. Araújo 278* (EAC); Planalto da Ibiapaba, Mun. Tianguá, 19 Nov. 1994 (st), *A. G. Fernandes & F. J. A. Matos EAC 21465* (EAC); Planalto da Ibiapaba, BR-222, 3 km from Tianguá, 3°45′S, 41°01′W, ca. 800 m, 21 Mar. 2000 (st), *Delprete et al. 7196* (EAC, NY, *uva* [Universidade Vale do Acaraú]), *7197* (EAC, *uva*), *7198* (EAC, NY, *uva*), *7199* (EAC, NY, uva), *7203* (EAC, uva); Chapada do Araripe, Mun. Crato, Sítio Mirindiva, 7°17′S, 39°33′W, 900 m, 29 Mar. 2000 (young fr), *Delprete et al. 7304* (EAC, NY, *uva*), *s.n.* (EAC, K, MO, NY, US); Chapada do Araripe, Mun. Crato, 19 Sep. 2001 (fr), *F. S. Cavalcanti & E. Silveira 843* (EAC, NY, *uva*).

Psychotria L., as traditionally recognized, is one of the largest genera of flowering plants, with about 2000 species worldwide. Several authors have tried to organize this taxonomic conundrum, either by dividing it into several smaller genera (e.g., Bremekamp, 1934), or by treating it as a large genus with many sections (e.g., Steyermark, 1972, 1974). *Psychotria* s.l. has been shown to be paraphyletic in the molecular phylogenies presented by Andersson and Rova (*rps*16; 1999), and Nepokroeff et al. (ITS and *rbc*L; 1999). Following the molecular data published by these authors and additional morphological evidence, the genera *Notopleura* Bremekamp and *Carapichea* Aublet have been recently resurrected by Taylor (2001) and Andersson (2002), respectively. *Notopleura* is easily distinguished, among other morphological characters, by its pseu-







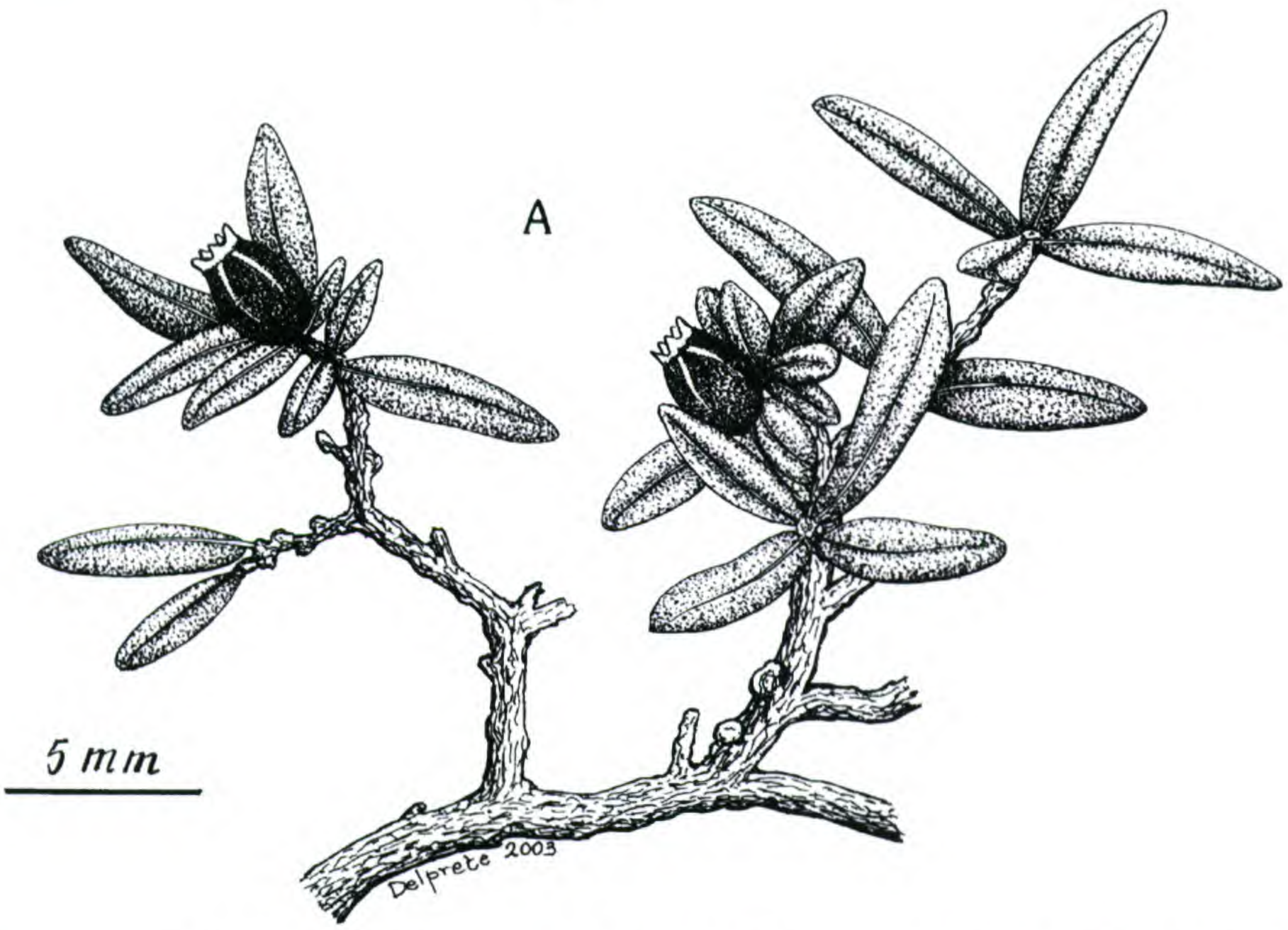


Figure 1. *Psychotria carrascoana* Delprete & E. B. Souza. —A. Branch with immature fruits. —B. Short-shoot with solitary, terminal flower bud. —C. Flower in anthesis. —D. Style. —E. Section of open corolla. —F. Mature fruit. A and F from photos of living material; B–E, from *Araújo 1054* (types, EAC, NY).

doaxillary inflorescences, and the sheathing stipules with an interpetiolar appendage inserted below the upper margin (Taylor, 2001); and *Carapichea* by its terminal, condensed inflorescences subtended by foliose bracts, pyrenes with germination slits on abaxial ridges, and persistent stipules, withering on the stem (Andersson, 2002; Delprete, 2001, 2003). The rest of the *Psychotria* complex, currently divided into subgenus *Psychotria* (Steyermark, 1972: 444) and subgenus *Heteropsychotria* Steyermark (1972: 484), remains taxonomically unresolved, and its close relationship with *Palicourea* Aublet has been addressed (e.g., Müller Argoviensis, 1881; Nepokroeff et al., 1999), but not yet resolved (Taylor, 1996, 1997, and work in progress).

About 11 species of *Psychotria* are known from the state of Ceará (Delprete et al., 2001), and among them *Psychotria carrascoana* is the species with the smallest leaves, and the only one with solitary (or rarely paired) flowers. This species has often been collected when sterile, mostly because of its minute, usually solitary, greenish white flowers, and therefore difficult to spot during anthesis. Because of the reduced, triangular stipules, leaves drying pale green, terminal flowers commonly solitary (or rarely in pairs), fruits red, and pyrenes dorsally tricostate, *Psychotria carrascoana* is placed in *Psychotria* subg. *Heteropsychotria*. This species is most similar to *Psychotria subtriflora* Müller Argoviensis (Zappi & Stannard, 1995: 571) because of the pauciflorous, subsessile, terminal inflorescences, but it differs by having stipules triangular (vs. bilobed, lobes narrowly triangular in *P. subtriflora*), inflorescences not subtended by bracts (vs. subtended by navicular bracts in *P. subtriflora*), corolla tube 1.7–2.8 mm long (vs. 6–7 mm long in *P. subtriflora*), and red fruits (vs. purplish blue in *P. subtriflora*).

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Una Nueva Especie de *Tibouchina* (Melastomataceae) de Guerrero, México

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RESUMEN. Se describe e ilustra *Tibouchina araneicalyx* de la vertiente del Océano Pacífico de la Sierra Madre del Sur en Guerrero, México. Se discuten las posibles relaciones de esta especie con *T. mexicana* (D. Don) Cogniaux y otras especies con flores pentámeras y estambres fuertemente dimórficos, de las que se distingue principalmente por tener ramas agudamente tetrágonas, lóbulos del cáliz triangulares más cortos que el hipantio y pétalos con cilios eglandulares.

ABSTRACT. *Tibouchina araneicalyx* is described and illustrated from the Pacific slopes of the Sierra Madre del Sur in Guerrero, Mexico. Its possible relationships with *T. mexicana* (D. Don) Cogniaux and another Mexican species of *Tibouchina* with pentamerous flowers and strongly dimorphic stamens are discussed; it is principally distinguished from these species by the sharply tetragonal branches, the triangular calyx lobes shorter than the hypanthium, and the petals with eglandular cilia.

Key words: Guerrero, Melastomataceae, México, *Tibouchina*.

Tibouchina Aublet, con poco más de 350 especies, es el género de frutos capsulares con mayor número de especies de la familia Melastomataceae (Almeda, 1993; Renner, 1993). Se distribuye desde el norte de Argentina hasta el noroeste de México, con su máxima diversidad en la cuenca del Amazonas y regiones andinas adyacentes, con alrededor de 10 especies en las Antillas y en América Central. En México esta representado por 25 especies de las cuales 21 o 22 son endémicas del país, para un endemismo de 84 a 88%, el más alto dentro de los distintos géneros de Melastomataceae presentes en México, esto de acuerdo con los principales tratamientos que han descrito o revisado las distintas especies del género presentes en México (Cogniaux, 1891; Brandegee, 1913, 1914; Standley, 1924; Wilson, 1958; Williams, 1963; Wurdack, 1967; Almeda, 1993; Todzia, 1999).

De las 25 especies antes mencionadas, 9 de ellas, incluyendo la que se describe en este trabajo, presentan dos series de estambres fuertemente dimórficos, los mayores con las tecas y conectivo rosados a rojizo-violáceos mucho más largos que en los estambres menores que tienen anteras y conectivo amarillos, constituyendo un grupo claramente diferenciado en el que *Tibouchina breedlovei* Wurdack, *T. chiapensis* Wurdack y *T. roseotincta* Todzia presentan flores estrictamente tetrámeras, mientras que *T. araneicalyx* descrita aquí, *T. durangensis* Standley, *T. galeottiana* (Triana) Cogniaux, *T. mexicana* (D. Don) Cogniaux, *T. rufipilis* (Schlechtendal) Cogniaux y *T. thulia* Todzia son básicamente pentámeras, con algunas flores tetrámeras, hexámeras o muy raramente heptámeras en las inflorescencias (obs. pers.).

En los herbarios mexicanos más importantes *Tibouchina* se encuentra representado por un número abundante de colectas. Debido a la compleja taxonomía del género, a su abundante variación morfológica y a la carencia de claves y descripciones adecuadas para las especies mexicanas, en numerosas ocasiones el material se encuentra mal determinado o sin asignación de especies. Por tal motivo, actualmente se realiza una revisión de los ejemplares de este género con el objetivo de ubicar claramente las especies presentes en México. Del material revisado, tanto de los herbarios antes mencionados como de la amplia colección del proyecto "Flora de Guerrero" de la Facultad de Ciencias de la Universidad Nacional Autónoma de México (UNAM) actualmente en revisión, se detectaron varios especímenes de un taxón procedente de la Sierra Madre del Sur de Guerrero con estambres marcadamente dimórficos. Dado que tiene hipantios con pelos no glandulares, el taxón se encuentra relacionado con *T. mexicana*, *T. rufipilis* y *T. thulia*, especies de las que se distingue principalmente por tener las ramas agudamente tetrágonas, los lóbulos del cáliz triangulares más cortos que el hipantio y los pétalos con cilios no glandulares, por lo que se propone en este trabajo como una especie nueva para la ciencia.

Tibouchina araneicalyx de Santiago, sp. nov. TIPO: México. Guerrero: Mun. Atoyac de Alvarez, aproximadamente a 2 km al W de El Molote, 17°25′06″N, 100°10′41″W, 1650 m, 5 dic. 2000, *Ricardo de Santiago 870* (holótipo, MEXU; isótipos, CAS, ENCB, FCME, MO). Figura 1.

Tibouchina sect. *Diotanthera. T. mexicanae, T. rufipili* et *T. thuliae* affinis, sed ramis ramulisque acute tetragonis, calyce lobis subulatis vel linearibus hypanthio brevioribus et petalorum ciliis eglandulatis differt.

Arbusto de 0.6–1.2 m con la pubescencia en las distintas estructuras de pelos tenuemente rojizo-purpúreos hacia la base o totalmente blanquecinos; entrenudos distales agudamente tetrágonos pubescentes con pelos basalmente geniculados y mayormente adpresos, de 0.2–2 mm de largo a glabrescentes. Peciolos de 0.7–2.6 cm de largo con pelos adpresos a subadpresos de 0.2–2 mm de largo; lámina ovada, membranácea, de 4–11.7 × 1.8–5.2 cm, ápice gradualmente acuminado, base aguda o redondeada, margen entero y ciliolado con ciliolos de 1.6–2.4 mm de largo, 5-nervada, el primer par de nervios laterales surgiendo de la base y el segundo de más arriba, superficie adaxial con pelos delgados parcialmente adnados, con la parte adnada blanquecina de 0.5–0.9(–1.2) mm de largo y la libre flexionada hacia arriba en la base de (0.7–)1.0–1.6 mm de largo, la abaxial en las venas primarias y secundarias con pelos basalmente geniculados adpresos de hasta 1.6 mm de largo y con pelos simples semiabiertos de 0.4–1.1 mm de largo en las venas terciarias. Inflorescencia un dicasio compuesto, corimbiforme, de 2.5–5 cm de largo, las brácteas basales semejantes a las hojas vegetativas, con la base atenuada, corto-pecioladas o sésiles, ovadas a anchamente elípticas; pedúnculos con pubescencia similar a la de las ramas vegetativas, de 0.7–5.5 mm de largo; bractéolas triangulares a angostamente triangulares, membranáceas, de 0.6–3.6 × 0.5–1.2 mm, ciliadas, con una seta terminal de hasta 3.5 mm de largo, glabras adaxialmente y con pelos semiabiertos dispersos en la superficie abaxial; pedicelos de 3.2–4.5 mm de largo con pelos delgados, ascendentes, de 2–3.3 mm de largo. Hipantio en antesis campanulado, de 5.0–6.0 × 4.0–4.5 mm, con pelos delgados, ascendentes a patentes, de 2–3.3 mm de largo; tubo del cáliz de aproximadamente 0.25 mm de largo; lóbulos del cáliz de 3.8–4.3(–5.3) mm de largo, angostamente triangulares a triangular-lineares, asimétricos, reflejos, la superficie adaxial verde a rojiza y glabra o esparcidamente pubescente hacia el ápice, el margen y la superficie abaxial hirsútulos con pelos delgados de 2–3.3 mm de largo; pétalos (4–)5(–7), rosados a lilas, obovados con el ápice obtuso o redondeado, de 12–14.5 mm de largo y de 9 mm de ancho, glabros, con el margen diminutamente ciliado con pelos rojizos de 0.1–0.5 mm de largo y una seta apical de 0.6–1.6 mm de largo; estambres (8–)10(–14), fuertemente dimórficos, glabros, curvados introrsa o extrorsamente; estambres mayores: filamentos rosados de 7.3–8 mm de largo, anteras rojizas de 9.3–11 mm de largo, tecas lineal-subuladas de 6–7.3 mm de largo con un poro apical inclinado ventralmente de 0.2–0.26 mm de diámetro, conectivos prolongados en la base 3.3–4 mm con dos lóbulos ventrales basales amarillos lineares con el ápice agudo o globosos de 0.8–1.1 mm de largo; estambres menores: filamentos blanquecinos de 5.5–5.7(–6.7) mm de largo, anteras amarillas de 4.8–7 mm de largo, tecas de 4.3–6 mm de largo con un poro apical inclinado ventralmente de ca. de 0.2 mm de diámetro, conectivos prolongados en la base 0.5–1 mm con dos lóbulos ventrales lineares a triangulares de 0.6 mm de largo; ovario elipsoide de 4.8–6.3 mm de largo, esparcidamente pubescente con pelos erectos de cerca de 0.2 mm de largo, en flores viejas (4–)5(–6)-lobulado en el ápice con pelos erectos de 0.2–1 mm de largo; estilo erecto y curvado hacia el ápice, de 10.5–12.5 mm de largo, glabro o raramente corta y esparcidamente pubescente hacia la base; estigma puntiforme. Fruto una cápsula con el hipantio y los lóbulos del cáliz persistentes; semillas cocleadas, tuberculadas, de 0.44–0.48 × 0.28–0.34 mm.

Distribución. Tibouchina araneicalyx es endémica de dos localidades de la vertiente al Océano Pacífico de la Sierra Madre del Sur en Guerrero. La primera de ellas en la zona limítrofe entre los municipios de Petatlán y Tecpan de Galeana, ampliamente dominada por el bosque de *Pinus*, entre 1340 y 1500 m de altitud. La otra localidad se encuentra en borde de cafetales entre 1630 y 1700 m de altitud en la zona montañosa al norte del municipio de Atoyac de Alvarez y al sur del cerro Teotepec, dentro de un bosque mesófilo de montaña alterado dominado por *Alfaroa costaricencis* Standley y diferentes lauráceas; este bosque es, probablemente, uno de los más ricos en melastomatáceas dentro de México con alrededor de 24 especies (Lozada et al., 2003), de las que se pueden destacar las recientemente descritas *Miconia teotepecensis* de Santiago y *Tibouchina roseotincta* Todzia, además de *Miconia donaeana* Naudin, *Miconia mirabilis* (Aublet) L. Williams y *Blakea guatemalensis* Cogniaux cuyos únicos registros dentro de México se han colectado dentro de esta zona.

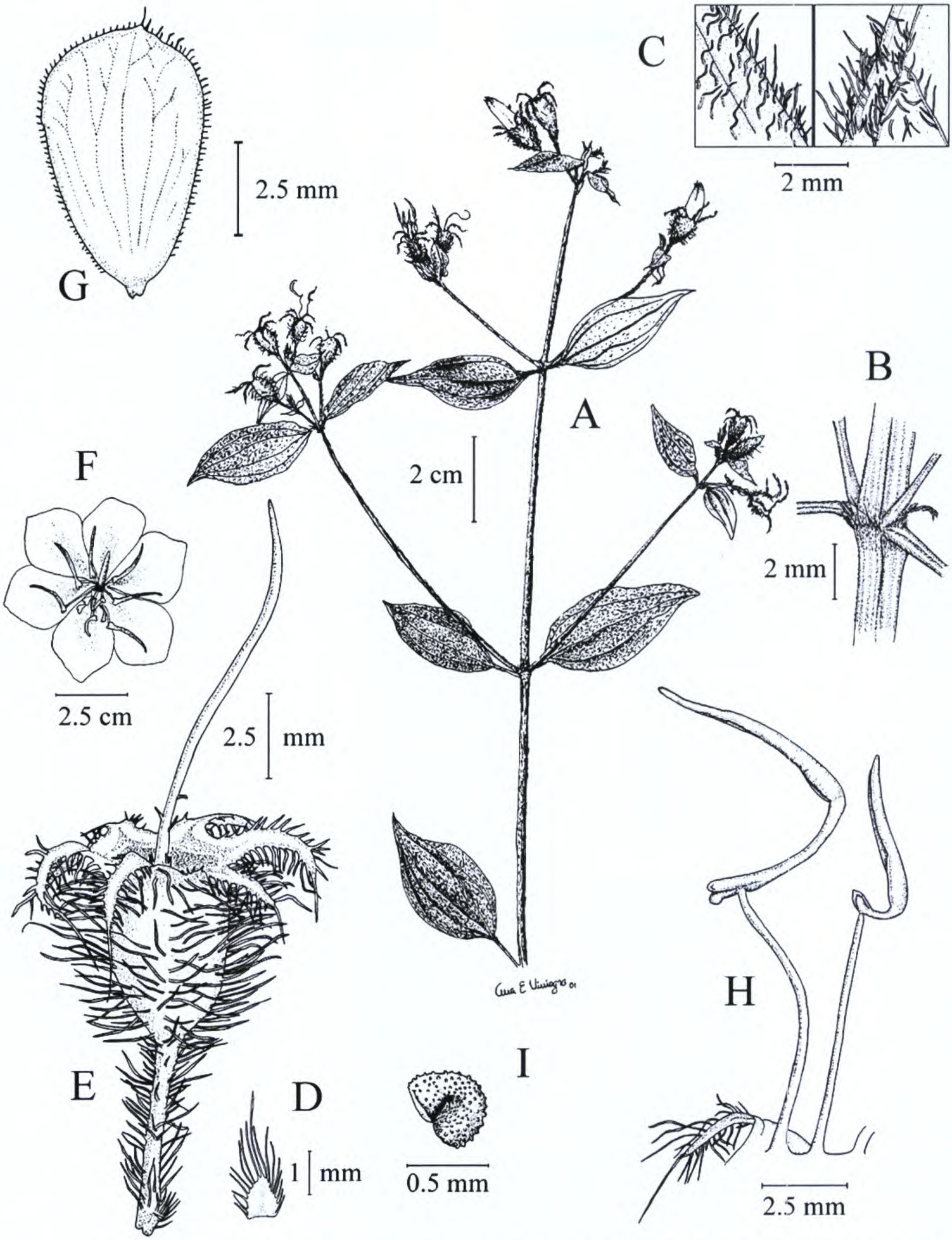

Figura 1. *Tibouchina araneicalyx* de Santiago. —A. Rama con flores. —B. Rama, detalle del nudo. —C. Hoja, detalles de la pubescencia adaxial (izquierda) y abaxial (derecha). —D. Bractéola. —E. Flor, estambres y pétalos removidos. —F. Flor. —G. Pétalo. —H. Estambres, antisépalo (izquierda) y antipétalo (derecha). —I. Semilla. A–H, del tipo *de Santiago 870*; I, *de Santiago 902*.

Fenología. El material en floración se colectó en los meses de noviembre y diciembre mientras que la colecta de material con frutos se realizó en abril.

Etimología. El nombre de esta especie se refiere a la apariencia de araña de las flores después de la caída de los pétalos, conferida por la larga pubescencia en el hipantio y cáliz y por los sépalos reflejos.

Tibouchina araneicalyx se encuentra cercanamente relacionada con *T. mexicana*, *T. rufipilis* y *T. thulia*, todas ellas con flores pentámeras, hipantio con pubescencia no glandular y estambres marcadamente dimórficos (las mayores con las anteras rosadas a rojizas, con las tecas curvadas y el conectivo largamente prolongado). *Tibouchina araneicalyx* difiere de estas especies por sus ramas agudamente tetrágonas, la presencia de pelos tenuemente rojizo-purpúreos hacia la base que le confieren un aspecto rojizo a las diferentes estructuras, inflorescencias axilares con 3–7 flores o terminales con 7–13 flores, bractéolas glabras en la superficie adaxial, flores básicamente pentámeras pero ocasionalmente tetrámeras o hexámeras, hipantio con pelos delgados ascendentes o patentes de 3 mm o más de largo, lóbulos del cáliz estrechamente triangulares a lineares siempre más cortos que el hipantio y pétalos con cilios eglandulares. *Tibouchina mexicana* se asemeja a *T. araneicalyx* por sus ramas con pelos adpresos de menos de 2 mm, pero difiere de ésta por su pubescencia de pelos totalmente blanquecinos, sus ramas esparcidamente pubescentes, obtusamente tetrágonas al madurar, sus hojas 3-nervadas de menos de 2 cm de largo, sus flores siempre pentámeras, mayormente solitarias o en inflorescencias con pocas flores (5–7) no dispuestas en glomérulos corimbiformes, sus bractéolas pubescentes en ambas superficies, el hipantio con pelos patentes de hasta 1.4 mm de largo, los lóbulos del cáliz oblanceolados con la superficie adaxial pubescente iguales o más largos que el hipantio y los pétalos con cilios glandulares. *Tibouchina rufipilis* tiene ramas distales obtusamente tetrágonas o aplanadas cambiando a cilíndricas al madurar, café-rojizas con pelos adpresos a ascendentes de hasta 6 mm de largo; inflorescencias con 1–7(–13) flores, bracteolas pubescentes en ambas superficies, hipantio con pelos ascendentes de hasta 1.6 mm de largo, lóbulos del cáliz oblanceolados algunas veces más cortos que el hipantio, pero por lo general iguales o más largos que éste, y pétalos con cilios glandulares. Por último, *T. thulia* tiene el tallo con pelos adpresos de 1–2 mm de largo parcialmente glandulares, inflorescencia con 1–3 flores, hipantio de 8–9 mm de largo con pelos adpresos de 1–2 mm, lóbulos del cáliz oblanceolados de 10–12 mm de largo y los pétalos con cilios glandulares.

Tibouchina roseotincta, también con estambres marcadamente dimórficos pero con flores estrictamente tetrámeras, se encuentra también en la localidad tipo de *T. araneicalyx*; además del número de partes florales, difiere claramente de la segunda por sus ramas distales aplanado-surcadas y menos robustas con pubescencia más densa de pelos blancos o rojizos de menos de 0.5 mm de largo, sus pecíolos de menos de 1 cm de largo, sus hojas estrechamente elípticas de 2.5–5.1 × 0.7–2 cm con pelos generalmente de menos de 0.5 mm en ambas superficies y sus bractéolas cordadas de hasta 1 × 0.6 cm que rodean al hipantio antes de la antesis.

Otras especies mexicanas con estambres marcadamente dimórficos son: con flores tetrámeras *Tibouchina breedlovei* de Chiapas, *T. chiapensis* de Chiapas y Oaxaca y la ya mencionada *T. roseotincta* de Guerrero; con flores pentámeras pero con pelos glandulares en el hipantio *T. galeottiana* de Querétaro, Hidalgo, Puebla y Veracruz y *T. durangensis* de Durango. A continuación se presenta una clave en que se incluyen además de *T. araneicalyx* todas las especies mexicanas de *Tibouchina* con los estambres descritos anteriormente:

Clave para las Especies Mexicanas de *Tibouchina* con Estambres Marcadamente Dimórficos

1a. Flores exclusivamente tetrámeras.
  2a. Hipantio con tricomas ascendentes, glandulares.
    3a. Ramas e hipantio con pelos lisos (no ramificados) . . . . . *T. breedlovei*
    3b. Ramas e hipantio con pelos cortamente barbelados . . . . . *T. chiapensis*
  2b. Hipantio con tricomas adpresos no glandulares . . . . . *T. roseotincta*
1b. Flores básicamente pentámeras (ocasionalmente hexámeras o heptámeras en *T. galeottiana* y tetrámeras, hexámeras o heptámeras en *T. araneicalyx*).
  4a. Hipantio con pelos glandulares.
    5a. Ramas con pelos alargados adpresos o abiertos, hojas basalmente nervadas . . . . . *T. galeottiana*
    5b. Ramas con pelos cortos adpresos, hojas plinervadas . . . . . *T. durangensis*
  4b. Hipantio con pelos no glandulares.
    6a. Lóbulos del cáliz más cortos que el hipantio, triangulares o lineares, pétalos con cilios eglandulares . . . *T. araneicalyx*
    6b. Lóbulos del cáliz iguales o más largos que el hipantio, generalmente oblanceolados, pétalos con cilios glandulares.
      7a. Hipantio con pelos adpresos, tallo con algunos pelos glandulares . . . . . *T. thulia*

7b. Hipantio con pelos ascendentes o patentes.
  8a. Ramas con pelos largos (0.8–3 mm) café-rojizos adpresos a patentes, hipantio con pelos rectos subadpresos . . *T. rufipilis*
  8b. Ramas con pelos blanquecinos adpresos de menos de 2 mm, hipantio con pelos patentes más o menos flexuosos . . . . . *T. mexicana*

Parátipos. MÉXICO. **Guerrero:** Mun. Atoyac de Álvarez, 2 km al W de El Molote, 5 dic. 2000, *de Santiago 868* (MEXU), 5 dic. 2000, *de Santiago 869* (CAS, ENCB, FCME, MO, UAGC, UAMIZ, XAL); cañada a 0.5 km W de El Molote, 5 dic. 2000, *de Santiago 883* (ENCB, FCME, MEXU), 18 abr. 2001, *de Santiago 902* (MEXU), 21 abr. 2001, *de Santiago 911* (FCME, MEXU), 10 dic. 2001, *de Santiago 939* (CAS, ENCB, FCME, MEXU, MO, UAGC), 10 dic. 2001, *de Santiago 940* (FCME, MEXU), 10 dic. 2001, *de Santiago 941* (FCME, MEXU); Mun. Petatlán, El Venado, 1 nov. 1991, *de Santiago 81* (ENCB, FCME, MEXU, MO); El Venado, 17 nov. 1994, *de Santiago 486* (ENCB, FCME, MEXU, MO), 17 nov. 1994, *de Santiago 489* (ENCB, FCME, MEXU, MO).

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A New Species of *Dyckia* (Bromeliaceae) from Rio de Janeiro State, Brazil

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ABSTRACT. A new seaside endemic species, *Dyckia martinellii* B. R. Silva & Forzza, from Rio de Janeiro State, Brazil, is described and illustrated. The genus was represented in this state only by *D. pseudococcinea* L. B. Smith, from which *D. martinellii* can be distinguished by a rosette with a larger diameter; longer and wider leaves bearing straight, patent-antrorse larger spines; basal scape bracts densely arranged, with the others longer than or equaling the internodes; floral bracts castaneous, entire, white-lepidote; and sepals orange with a castaneous apex.

RESUMO. Uma nova espécie endêmica do litoral, *Dyckia martinellii* B. R. Silva & Forzza, do estado do Rio de Janeiro, Brasil é descrita e ilustrada. O gênero estava representado neste estado apenas por *D. pseudococcinea* L. B. Smith da qual *D. martinellii* pode ser diferenciada pela roseta de maior diâmetro; pelas folhas maiores e mais largas, espinhos patente-antrosos maiores; pelas brácteas basais do escapo congestas as demais maiores ou igualando os entrenós; brácteas florais castanhas, inteiras, alvo-lepidotas e pelas sépalas laranja com ápice castanho.

Key words: Brazil, Bromeliaceae, *Dyckia*, Pitcairnioideae, Rio de Janeiro state.

Dyckia Schultes & Schultes f., with ca. 200 species, is among the largest genera in Bromeliaceae subfamily Pitcairnioideae and the one with greatest diversity in Brazil, where approximately 80% of the species occur (Forzza, 2001). The members of this genus have an exclusively South American distribution, with diversity centers in southern Brazil within the cerrado and campos rupestres formations (Forzza, 2001). According to a phylogenetic analysis based on morphological characters, the genus *Dyckia* is monophyletic (excluding *D. biflora* Mez; Forzza, 2004). This is supported by four synapomorphies: an axial inflorescence; the scape bracts different from leaves; presence of nectaries on the sepals; and a petal-staminal ring (Forzza, 2001).

Dyckia martinellii B. R. Silva & Forzza, sp. nov. TYPE: Brazil. Rio de Janeiro: Mun. Paraty, Paratymirim, costões rochosos entre Paratymirim e Saco do Mamanguá, 5 m elev., 27 Sep. 1990 (fl), *G. Martinelli 14413* (holotype, RB). Figure 1.

Species nova *Dyckiae pseudococcineae* affinis, sed rosula foliorum circa 60 cm diam., foliis longioribus, latioribusque, spinis rectis vel patente-antrorsis et majoribus, bracteis scapalibus infernis foliis similibus, dense dispositis, supernis longioribus vel rare internodia aequantibus, bracteis floriferis castaneis, integris et albo-lepidotis, sepalis aurantiaceis apice brunneis differt; *D. encholirioidi* similis, sed propagulis basalibus brevioribus, rosula foliorum breviore, foliis brevioribus angustioribusque, floribus per anthesim patentibus, bracteis floriferis integris et albo-lepidotis, sepalis albo-lepidotis, aurantiaceis apice brunneis, petalis obtrullatis, aurantiaceis differt.

Plant rupicolous, flowering 70–100 cm high, propagating by stout basal shoots; rosettes ca. 60 cm diam. Leaves suberect-arcuate; sheaths elliptic, 2.5–3 × 5–6 cm, castaneous abaxially, whitish adaxially, margin entire except for a few evanescent spines in the transition to the blade; leaf blades 20–35 × 2.2–2.6 cm, lanceolate, apex attenuate, whitish abaxially, light green adaxially, margins spinose, spines straight, patent-antrorse, 3–4 mm long, 1–1.5 cm apart, light green with a castaneous apex. Scape erect, 55–97 cm long, 0.7–10 mm diam., green, sparsely white lepidote; scape bracts the basal ones subfoliaceous, densely arranged, spinulose, 11–12.5 × 0.9–1.2 mm, erect, chartaceous, sparsely lepidote; the upper ones exceeding to rarely equaling the internodes, lanceolate, chartaceous, stramineous, glabrous to sparsely lepidote, clasping the scape, apex attenuate, margins spinulose to inconspicuously serrulate; inflorescence simple, racemose, 30–43 cm long, laxly flowered, 38- to 65-flowered, rachis orange, sparsely lepidote, straight; floral bracts elliptic to elliptic-attenuate, acuminate, exceeding to equaling the middle of the sepals, 4–12 × 3–6 mm, castaneous, entire, white-lepidote. Flowers patent at anthesis, becoming suberect afterward, pedicellate, pedicels cylindrical, 1–2 mm long, orange, sparsely lepidote, reaching 4

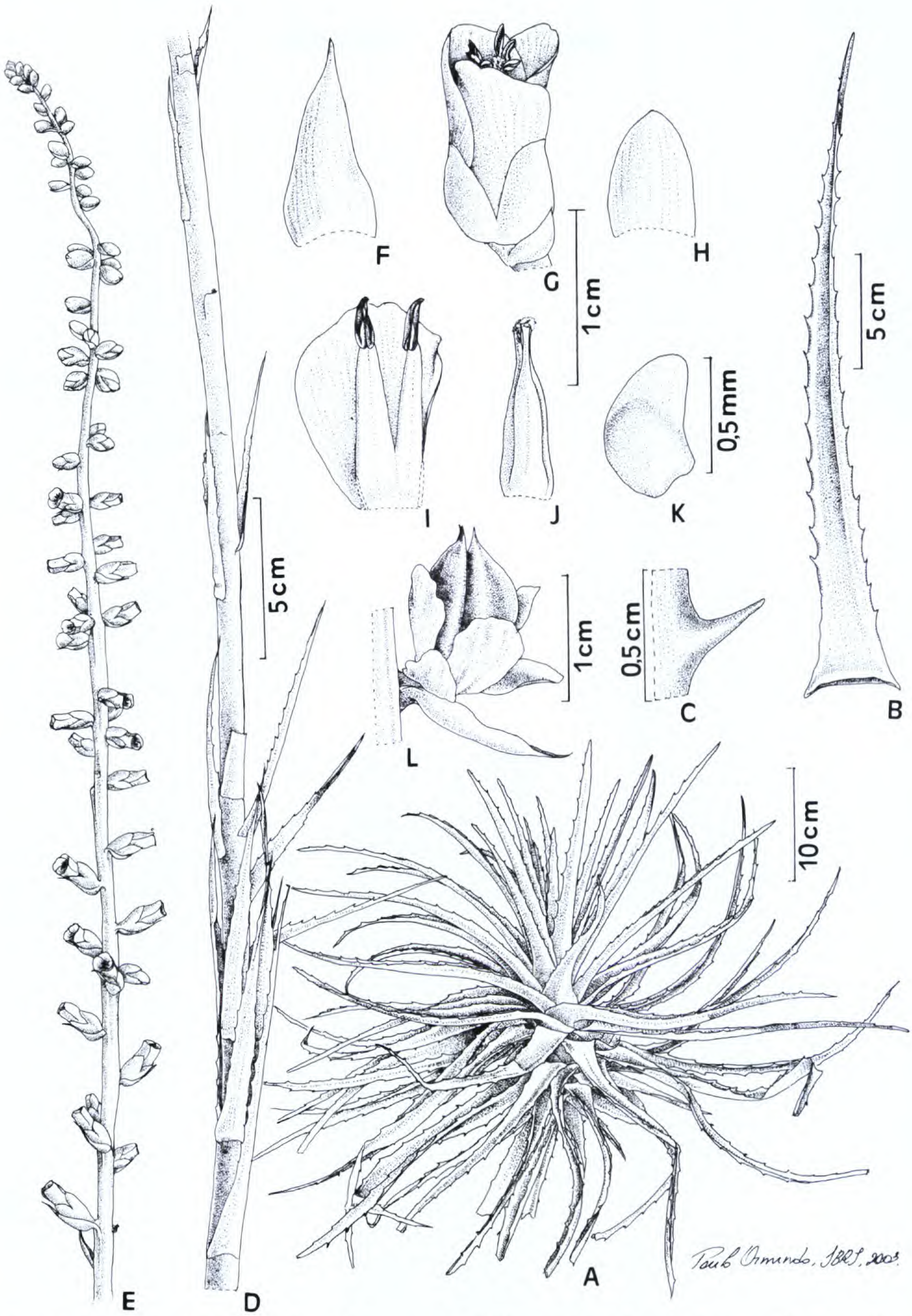

Figure 1. *Dyckia martinellii* B. R. Silva & Forzza. —A. Habit. —B. Leaf. —C. Spine. —D. Scape base. —E. Inflorescence. —F. Floral bract. —G. Flower. —H. Sepal. —I. Petal and stamens. —J. Gynoecium. —K. Ovule. —L. Capsule. Drawings based on *R. C. Forzza et al. 2386* (A–C), *G. Martinelli 14413* (D–K), *B. R. Silva 961* (L).

mm long in fructification; sepals ovate, apex rounded, 7–9 × 4–6 mm, white-lepidote, orange with a castaneous apex; petals orange, obtrullate, glabrous, apex emarginate, erect at anthesis, 9–12 × 9 mm; stamens included; filament connate for 3.5 mm, adnate to petal for 2.5 mm; anthers slightly sagittate at base, attenuate and reflexed at apex, ca. 3 mm long; ovary 7 mm long, ovule alate, ca. 0.7

Table 1. Comparison of *Dyckia encholirioides*, *D. martinellii*, and *D. pseudococcinea*.

	D. encholirioides	*D. martinellii*	*D. pseudococcinea*
Vegetative propagation	rhizomatous	basal shoots	basal shoots
Rosette diameter (cm)	ca. 100	ca. 60	ca. 40
Foliar blades (cm)	30–100 × 2.5–4	20–35 × 2.2–2.6	20–30 × 1–1.8
Foliar spines (mm)	antrorse, curved, 5–7	patent-antrorse, straight, 3–4	retrorse, curved, 1.5–2
Basal scape bracts	subfoliaceous, densely arranged, spinulose	subfoliaceous, densely arranged, spinulose	not foliaceous, sparse, inconspicuously serrulate
Scape bracts	longer than to rarely equaling the internodes	longer than to rarely equaling the internodes	much shorter than internodes
Anthesal flower position	reflexed	patent	patent
Floral bracts	ferrugineous-lanate, serrulate	white-lepidote, entire	reddish, serrulate
Sepals	ferrugineous-lanate	orange with castaneous apex, white-lepidote	reddish, glabrous
Petals	yellow, unguiculate	orange, obtrullate	orange, obtrullate

mm long. Fruits ca. 15 mm long; seeds alate, ca. 3 mm long.

Dyckia martinellii presents morphological affinities both toward *D. pseudococcinea* and *D. encholirioides* (Gaudichaud-Beaupré) Mez (Table 1), these being the only three species known from coastal southeastern Brazil.

Although the southern states of Rio Grande do Sul, Santa Catarina, and Paraná possess many *Dyckia* species, including seaside endemics, only one species was known from the southeastern State of Rio de Janeiro, *D. pseudococcinea*. São Paulo, another southeastern state of Brazil, is also relatively poor in seaside species: only *D. encholirioides* is known at present, with Ilha do Cardoso being its northern limit of distribution.

The new species was found growing on granite outcrops, from 3 to 10 m above the high tide line, the rocks often being washed by rainwater. By comparison, *Dyckia pseudococcinea* is a restricted endemic from an area of periodically inundated Eriocaceae restinga in the municipality of Maricá, Rio de Janeiro State. The specimen cited by Smith and Downs (1974) as originating in Atibaia, São Paulo, actually belongs to another species, *D. tuberosa* (Vellozo) Beer. The less selective *D. encholirioides* occurs on rocks or sand along the coast from Rio Grande do Sul to São Paulo, a completely subtropical distribution (Smith & Downs, 1974).

This new taxon has only been collected from a population on a granite outcrop with an inclination angle of ca. 45°. The outcrop occupies an area of approximately one hectare and is densely vegetated with *Vellozia candida* Mikan, *Alcantarea edmundoi* (Leme) J. R. Grant, *Vriesea neoglutinosa* Mez, *Cattleya intermedia* Graham ex Hooker, *Cyrtopodium polyphyllum* (Vellozo) L. C. Menezes, *Cereus*, *Tibouchina*, and *Pitcairnia*. Well represented here, *Dyckia martinellii* grows mainly in the shade of the shrubs, the deepest shade being the place where the largest specimens were found. This fact may explain its late discovery since it renders the specimens almost invisible from passing boats, the only means of transportation to the site. Many other seaside outcrops with similar characteristics exist in the region of Paraty and the nearby Ubatuba in São Paulo and should be surveyed to establish the species' biological range.

Paratypes. BRAZIL. **Rio de Janeiro:** Mun. Paraty, Paratymirim, costões rochosos entre Paratymirim e Mamanguá, 5 m elev., 30 May 1990 (fr), *G. Martinelli 12089* (RB); 23°14′06″S, 44°37′62″W, 17 Nov. 2002, fl cult. Dec. 2002, *B. R. Silva 961* (RB), 5 Feb. 2003 (fr), *R. C. Forzza 2386, B. R. Silva & E. Borges* (MO, RB).

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A New Species of *Polyalthia* (Annonaceae) from China

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ABSTRACT. The new species *Polyalthia zhui* X. L. Hou & S. J. Li, found from Hainan and southern Guangdong in southern China, is described and illustrated. It has previously been confused with *Polyalthia nemoralis* A. DC. or *P. littoralis* (Blume) Boerlage in China, but is distinguished on the basis of its green fleshy ovate petals, outer petals spreading ca. 4 × 2.5 mm, inner petals not fully spreading, somewhat bent to the inside, ca. 5–6 × 4–4.2 mm, 1 mm thick or more, its carpels pilose only in the lower half, and its non-lobed stigma.

Key words: Annonaceae, China, *Polyalthia*.

Polyalthia Blume, with 150 to 160 species, is the largest annonaceous genus in Asia (Van Heusden, 1992). Its species are mainly distributed in tropical Asia, New Guinea, Australia, the Solomon Islands, Fiji, Madagascar, and East Africa (Van Heusden, 1992; Verdcourt, 1971) and are especially numerous in Southeast Asia (Sinclair, 1955). There are 32 species in Singapore (Sinclair, 1955), 27 in Vietnam (Ban, 2000), 7 in Sri Lanka (Huber, 1985), and 8 in Burma (Kurz, 1974). The northern distribution edge of *Polyalthia* is in southern China; there are 17 species in Guangdong, Guangxi, Yunnan, and Hainan Provinces (Tsiang & Li, 1979).

The systematics of Annonaceae from China is the first author's Ph.D. thesis, and the present paper is a part of this study. In the last three years, nearly all Annonaceae herbarium collections in China (about 10,000 sheets) were checked, and several field investigations were carried out concurrently.

At the South China Institute of Botany (IBSC), we found that some specimens cited as *Polyalthia nemoralis* A. DC. by Merrill and Chun (1940) were heterogeneous with the others, i.e., *How 70423* (IBSC), *Lau 2843* (IBSC), *Liang 66027* (IBSC), *Liang 62116* (IBSC), *Liang 62794* (IBSC), *Liang 63904* (IBSC), *Liang 66500* (IBSC), *Tso & Chun 44581* (IBSC), *Tso & Chun 44717* (IBSC). We temporarily regarded them as doubtful specimens for lacking flowers, and we did not confirm they are our new species, *P. zhui*, until we had observed the flowers of the *Hainan Western Expedition 264* (IBSC). Its outer petals are ovate, 4 × 2.5 mm, its inner petals are ovate, 5–6 × 4–4.2 mm, 1 mm thick or more, pubescent outside, while *P. nemoralis* petals are oblong, 8 × 4 mm, only 0.4 mm

Table 1. Morphological comparison of *Polyalthia nemoralis* and *Polyalthia zhui*.

	Polyalthia nemoralis	*Polylalthia zhui*
Petals	White, densely pubescent outer side, chartaceous, less than 0.4 mm thick, oblong; inner petals 8 mm long	Green, pubescent outer side, fleshy, 1 mm thick or more, ovate-rounded; inner petals 5–6 mm long
Stamens	Connective apex convex, densely puberulent	Connective apex slightly concave, nearly glabrous
Ovaries	Densely gray pubescent, stigma bifid	Pilose only in the lower half, stigma unlobed
Fruit walls	Coherent with seeds	Separate from seeds
Leaf blade veins	Secondary veins incurved; intersecondary veins absent; veinlets unbranched; tracheids 0.3–0.5 mm	Secondary veins straight; intersecondary veins 6 to 8 pairs; veinlets 1- or 2-branched; tracheids less than 0.1 mm
Leaf	Length : width = 2.5–3 : 1	Length : width = 3–3.6 : 1

* Author for correspondence.

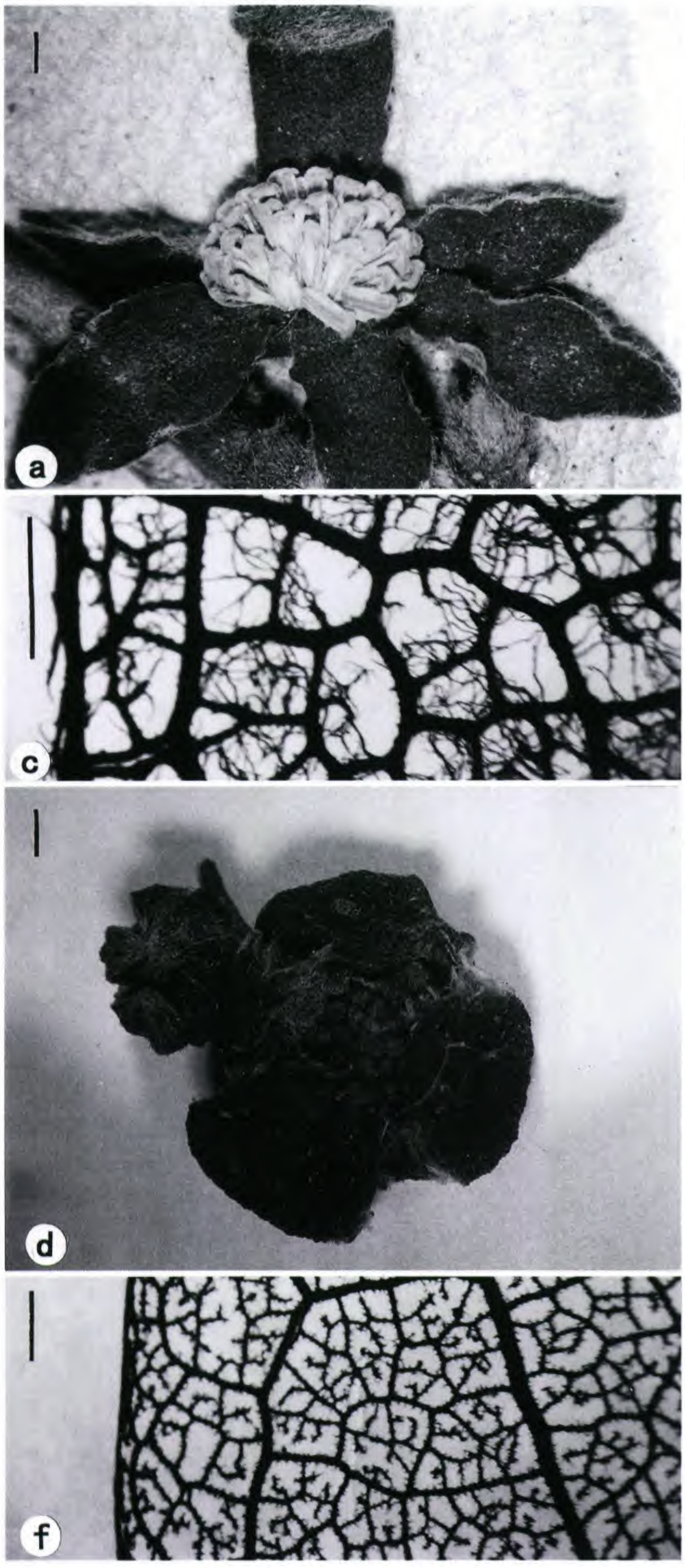

Figure 1a–c. *Polyalthia nemoralis* (from *H. R. Liang 61573*, IBSC). —a. Flower. —b. Leaf venation. —c. Leaf venation magnified. d–f. *Polyalthia zhui* X. L. Hou & S. J. Li (from the holotype, *Hainan Western Expedition 264*, IBSC). —d. Flower. —e. Leaf venation. —f. Leaf venation magnified. Scale bars: a, c, d & f = 1 mm; b & e = 1 cm.

Table 2. Morphological comparison of *Polyalthia littoralis* and *Polyalthia zhui*.

	Polyalthia littoralis	*Polyalthia zhui*
Ratio of inner petal length to outer petal length	2–2.6 : 1	1.4–1.6 : 1
Petal texture	thin-membranous	fleshy, 1 mm thick or more
Ratio of monocarpel length to the stalk of monocarpel length	2–3.1 : 1	4–5 : 1
Length of monocarpel stalk	3–6 mm	3 mm
Length of fruiting peduncles	ca. 12 mm	3–4 mm
Leaf blade	lanceolate, usually 2–3 cm wide	oblong-lanceolate or ovate-lanceolate, usually 3.5–4.2 cm wide

thick, and pilose outside. Further observation shows that these specimens also differ from *P. nemoralis* in carpels, fruit, stamens, and leaf venation (Table 1, Fig. 1).

After having compared the specimens with the known species of *Polyalthia* recorded in various floras and systematic treatments (Blume, 1830; Hooker & Thomson, 1855, 1872; Merrill, 1912, 1923; Sinclair, 1955; Backer & Bakhuizen, 1963; Huber, 1985; Ban, 2000), we found a few species with petals less than 10 mm long. Among these, only *P. littoralis* (Blume) Boerlage, whose distribution extends to Indonesia and Vietnam, is similar to *P. zhui*. We made sure, however, that *P. zhui* was distinct from *P. littoralis*. *Polyalthia littoralis* petals are thin-membranous, whereas *P. zhui* petals are thick-fleshy up to 1 mm or more. Furthermore, the two species can be distinguished by their leaves, monocarpels, and fruiting peduncles (Table 2). *Polyalthia littoralis* was reported as new to China by Li (1993). According to the specimens cited by Li (1993), however, his *P. littoralis* was Merrill and Chun's *P. nemoralis*, that is, it included *P. nemoralis* and *P. zhui*.

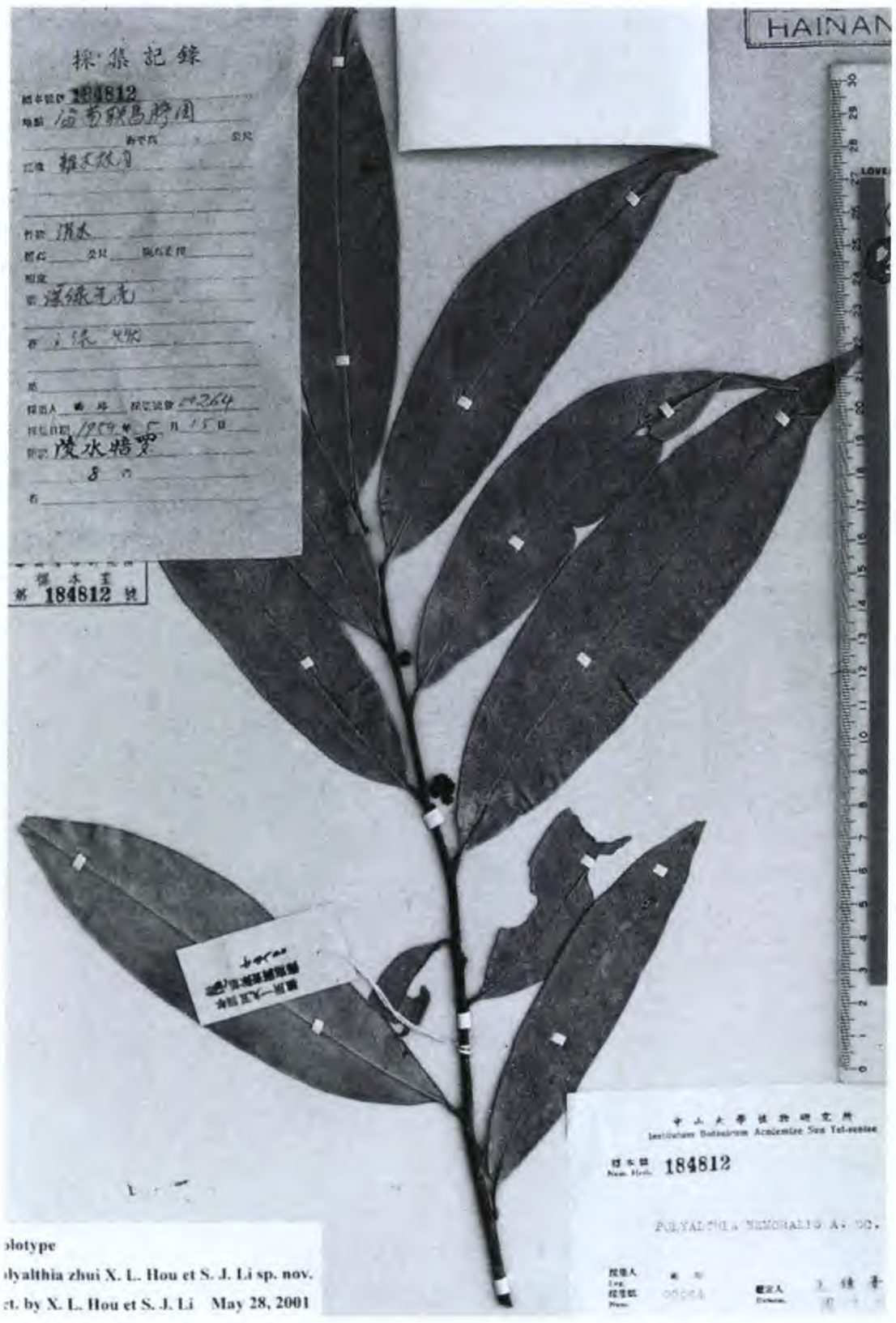

Figure 2. Holotype of *Polyalthia zhui* (*Hainan Western Expedition 264*, IBSC).

Polyalthia zhui X. L. Hou & S. J. Li, sp. nov. TYPE: China. Hainan: Danzhou City, Nada, Lianchangjiaoyuan, 15 May 1954, *Hainan Western Expedition 264* (holotype, IBSC; isotypes, IBK, KUN, PE). Figures 1D–F, 2, 3.

Affinis *Polyalthiae nemorali*, sed floribus ca. 6 mm diam., petalis exterioribus ovato-rotundis 4 mm longis, 2.5 mm latis, petalis interioribus ovato-rotundis, 5–6 mm longis, 4–4.2 mm latis, externis rare pubescentibus, carpellis meris pubescentibus in dimidio inferiore, stigmate non lobato, connectivo parum concavo differt.

Shrubs usually 1.5–3 m, rarely up to 5 m tall; bark dark brown; young twigs dark purple, striate, pubescent with appressed gray-yellow hairs, but quickly glabrescent. Leaves coriaceous, oblong-lanceolate or ovate-lanceolate, 9–16(–19) × 2.5–4.5(–5) cm, apex acuminate to obtuse-acuminate, base cuneate, glabrous, dark green above, lucid and pale green beneath, midrib slightly grooved above and obviously convex beneath, secondary veins 8 to 10 pairs, at 60° to 80° with the midrib, interarching 3–5 mm from the margin, reticulations somewhat prominent on both sides, intersecondary veins in 6 to 8 pairs; petioles 3–5 mm long, yellowish, rugose. Inflorescences extra-axillary with 1 (or 2) flowers; peduncles ca. 1 mm long; pedicels

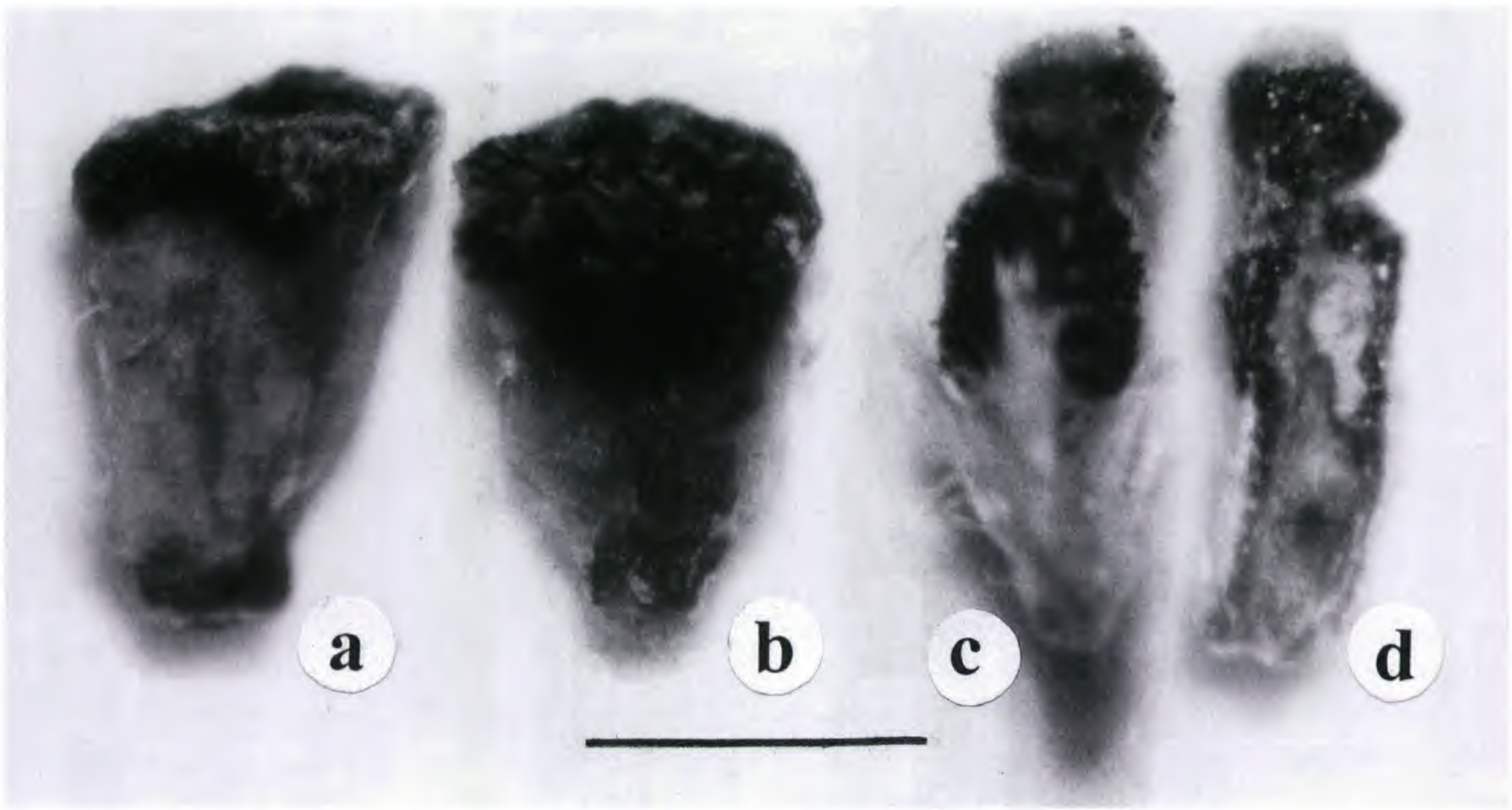

Figure 3. *Polyalthia zhui.* —a. Abaxial view of stamen. —b. Adaxial view of stamen. —c. Carpel. —d. Longitudinal section of carpel. Scale bar = 1 mm. (From the holotype, *Hainan Western Expedition 264*, IBSC.)

1–2 mm long, pubescent with gray-yellow hairs, bract 1, broadly ovate, 1–2 × 2 mm, acuminate. Flower green, ca. 6 mm diam. when mature; sepals connate at base, lobes 3, ovate, 2 × 1.8 mm, pubescent outside, glabrous inside, persistent; petals 6 in 2 whorls, fleshy, acute, pubescent outside, glabrous inside, outer petals ovate, flat, spreading, ca. 4 × 2.5 mm, inner petals ovate, flat, not fully spreading, somewhat bent to inside, 5–6 × 4–4.2 mm, ca. 1 mm thick or more; stamens ca. 50 to 100, cuneate, 1–1.3 mm long, ca. 1 mm wide, connective apex slightly concave, dark purple, glabrescent; carpels ca. 30, with one basal ovule each, 1.5–2 mm long, pilose with brown-yellow hairs in the lower half; stigma capitate, sessile, puberulent, not lobed. Monocarpels 4 to 7 (to 11), ellipsoid, 12–15 mm long, 8–10 mm diam., purple-red when dry, glabrous, densely tiny-dotted, stalks 3 mm long, pubescent; seed 1 per locule, ellipsoid, red, 10–12 mm long, 6–8 mm diam., separated from fruit walls, endosperm ruminative.

Distribution and habitat. In wet forest at 250–600 m, Hainan and southern Guangdong. In forest edges, sometimes along small streams. This was collected in flower April through July and in fruit July through February of the following year.

Polyalthia zhui is distinguished from the other species of *Polyalthia* by its oblong-lanceolate or ovate-lanceolate leaf shape, lucid and pale green beneath and 6 to 8 pairs of intersecondary veins, its relatively short pedicels and small green flowers with fleshy petals, its nearly glabrous and slightly concave connective apices, its capitate stigma, and its seeds not adherent to fruit walls.

Eponymy. *Polyalthia zhui* was named in honor of our master supervisor, Prof. Zhu Changshan, working in the Henan Agriculture University, who shared his rich knowledge of and correct methods for studying plant taxonomy.

Paratypes. CHINA. **Guangdong:** Xuwen Co., Mailaowo village, 31 Oct. 1951 (fr), *Z. S. Zhu 1036* (IBSC); Xuwen Co., Kengzai village, 26 Apr. 1936 (fr), *Hainan Southern Expedition 391* (IBK, IBSC, KUN, PE); Xuwen Co., Xuwenshan hill, near Yugonglou, 27 Sep. 1951 (fr), *S. H. Chun 7515* (IBSC); Xuwen Co., Guocheng village, 7 Nov. 1957 (fr), *Hainan Southern Expedition 152* (IBSC); Xuwen Co., Baishui village, 15 Apr. 1985 (fl), *Li & Xing 1985* (IBSC). **Hainan:** Baisha Co., a valley near Hongmaodong, 27 Apr. 1936, *S. K. Lau 26534* (IBSC, KUN); Baoting Co., Diaoluoshan Mountain, Baishuiling, 24 Nov. 1954, *Diaoluoshan Expedition 2815* (IBK, IBSC, PE); Changjiang Co., Jiaqieshan hill, 16 Oct. 1933 (fr), *S. K. Lau 2843* (A, IBSC); Changjiang Co., 20 Dec. 1933 (fr), *H. R. Liang 66027* (A, IBK, IBSC); Changjiang Co., Dec. 1933 (fr), *H. R. Liang 66102* (A, IBK, PE); Changjiang Co., 20 Dec. 1933 (fr), *H. R. Liang 66500* (IBK, IBSC, PE); Dongfang Co., Guangba District, Qicha, 17 Nov. 1956, *S. H. Chun 11134* (IBSC); Dongfang Co., Maanling, 6 Nov. 1978, *G. A. Fu 1391* (IBSC); Dongfang Co., Jianfengling, near Sanmojue village, 23 Mar. 1934, *S. K. Lau 3533* (SYS), *S. K. Lau 4924* (IBSC); Dongfang Co., *H. R. Liang 63094* (A, IBK, IBSC); Ledong Co., Taohui village, Taohuiling, *S. K. Lau 27454* (A, IBK, IBSC, KUN, PE); Lingshui Co., Nanwanling, 21 Jan. 1985, *G. A. Fu 5551* (IBSC); Sanya City, Nanshanling, 30 Dec. 1932, *Tso & Chun 44717* (A, IBK, IBSC, PE); Sanya City, Nanshanling, 26 Dec. 1932, *Tso & Chun 44581* (A, IBK, IBSC,

PE); Sanya City, Xiaobaokang, 16 July 1933 (fr), *H. R. Liang 62116* (A, IBK, IBSC, PE); Sanya City, Daposhan hill, 23 Aug. 1933, *H. R. Liang 62794* (A, IBK, IBSC); Sanya City, Yanglin, 24 Mar. 1933, *F. C. How 70423* (IBSC); Sanya City, Ganzhaling, upriver Fotian Reservoir, 30 Oct. 1987, *Z. X. Li 3058* (IBSC); Sanya City, Dabaokang, 16 July 1933, *C. Wang 33087* (IBSC, PE); Sanya City, Nanlin, Guikaishan hill, 16 Oct. 1933 (fr), *C. Wang 34633* (IBSC).

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A New Species of *Didymoplexiella* (Orchidaceae) from China

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ABSTRACT. *Didymoplexiella hainanensis* X. H. Jin & S. C. Chen, a new species of Orchidaceae from Hainan, China, is described and illustrated. The new species is related to *D. ornata* (Ridley) Garay, from which it differs by the dorsal sepal briefly connate with the petals, the lateral sepals connate ¼ to ⅓ at base, an articulate lip, and larger lateral lobes.

Key words: China, *Didymoplexiella*, Orchidaceae.

Didymoplexiella Garay is a leafless orchid genus of ca. seven species (Seidenfaden & Wood, 1992) mainly distributed in Indonesia, with a few species, e.g., *D. siamensis* (Rolfe ex Downie) Seidenfaden, extending to northern Thailand, China, and Japan. It is similar in habit and floral appearance to *Didymoplexis* Griffith, with which it was considered by some authors as congeneric (Holttum, 1953). Garay (1955) found enough distinction in floral column to justify a separation between them. The column of *Didymoplexiella* has a pair of long stelidia on either side of its stigma and lacks a distinct column foot, while that of *Didymoplexis* lacks stelidia and the column foot is distinct. The new species was collected in late March from Hainan Island and is no doubt a new member of *Didymoplexiella*. It is somewhat related to *D. ornata* (Ridley) Garay from Malaysia and Thailand, from which the new species is distinct by its almost separate dorsal sepal and petals, articulate lip, and much larger lateral lobes.

Didymoplexiella hainanensis X. H. Jin & S. C. Chen, sp. nov. TYPE: China. Hainan: Ledong, Jianfenlin Mt., 17 Mar. 2002 (fl), *H. K. Kadoorie Program Team 3087* (holotype, PE; isotype [spirit], MO). Figure 1.

Habitu *Didymoplexiellae ornatae* subsimilis, sed sepalo dorsali petalis breviter vel vix connato, sepalis lateralibus inter se tantum ¼ ad ⅓ parte inferiore connatis, labello multo longiore quam columna prope medium mobili-articulato bene differt.

Mycoheterotrophic plants; tuber creeping, cylindrical, 5–6 cm long, 3–10 mm diam., wrinkled, nodal; stem erect, slender, terete, 5–15 cm long, brown, nodal, sheathing on the lower half, with internodes 2–9 mm long; sheaths 1.5–2.5 mm long. Inflorescence 7–9 mm long, compactly 2- to 4-flowered; bracts triangular-lanceolate, 1.5–2 mm long; pedicel and ovary 5–15 mm long, brown. Flowers ca. 1.5 cm across, white except the lip mid-lobe yellow, dorsal sepal elliptic, 7–10 × 13 mm, briefly or scarcely united at base with petals, 3-nerved, obtuse; petals similar to dorsal sepal, 6–7 × 10 mm, joined with dorsal sepals for ¼ to ⅓ of their length; lateral sepals elliptic, 10–11 × 3.5–4 mm, 3-nerved, obtuse, connate at base to each other for ¼ to ⅓ of the length; lip 11–12 mm long, consisting of an apical blade 5.5–6 mm long and a basal claw 4.5–5 mm long, with an articulate joint between them; blade tri-lobed, with a basal claw, its upper surface a U-shaped callus covered with small warts; lateral lobes sub-oblong, ca. 5 × 4 mm with a slightly undulate margin, much larger than the mid-lobe; mid-lobe fleshy, ca. 3 × 2 mm at the apex, with stelidia on either side of the stigma; stelidia curved downward, 2.5–3 mm long; pollinia 4, mealy. Capsule not seen.

Distribution. China, Hainan Province, Ledong County, Jianfengling Mountains, alt. 700 to 800 m, in humid evergreen forest.

Paratype. CHINA. **Hainan:** Ledong, Jianfengling Mtn., 15 Mar. 2002 (fl), *Hong Kong Kadoorie Program Team 3081* (MO, [spirit] KUN).

Acknowledgments. We are indebted to the Ka-

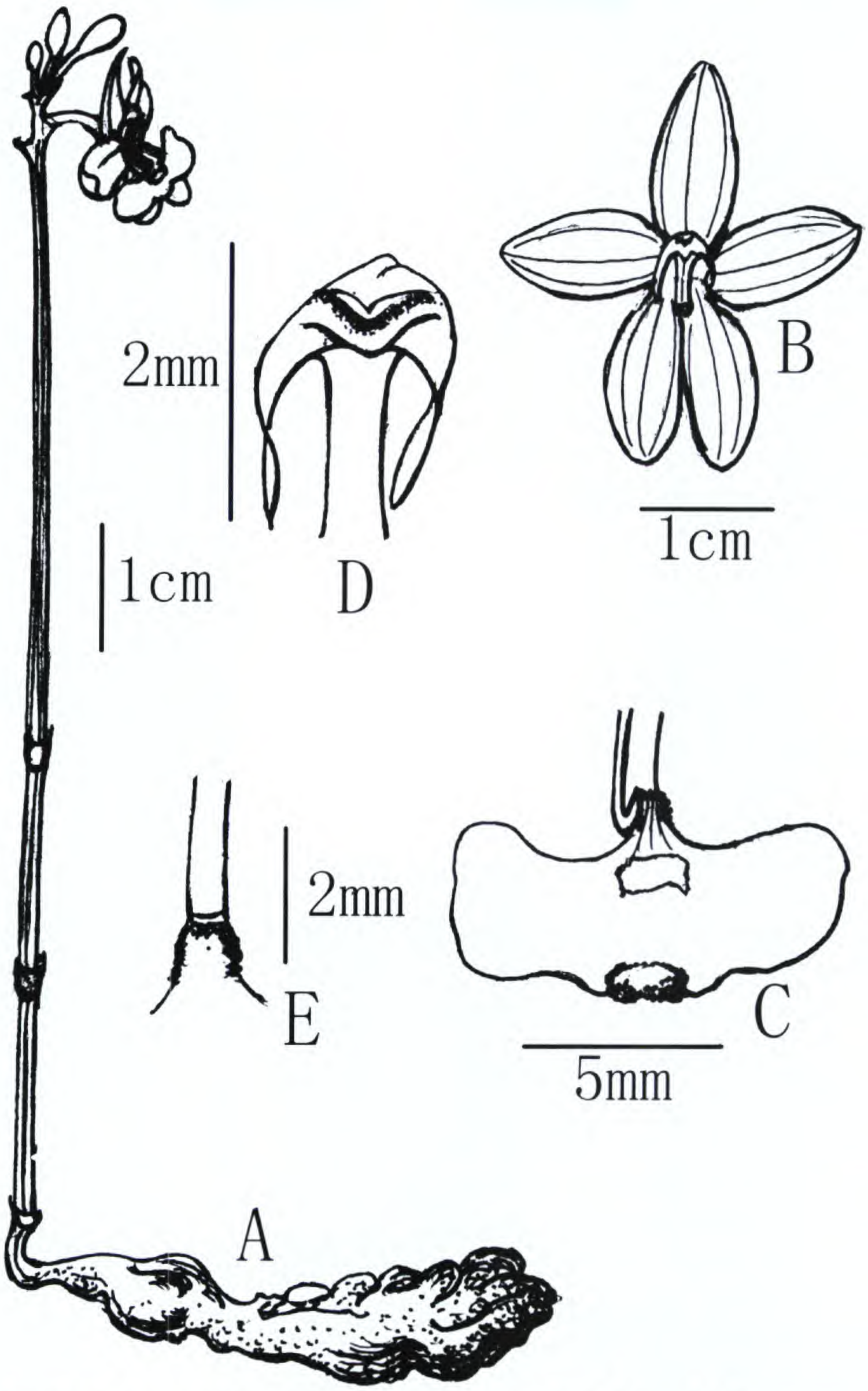

Figure 1. *Didymoplexiella hainanensis* X. H. Jin & S. C. Chen. —A. Habit and inflorescence. —B. Front view of sepals and petals. —C. Front view of lip. —D. Stelids. —E. The articulate claw. (*Based on Hong Kong Kadoorie Program Team 3087*, PE.)

doorie Farm and Botanic Garden, Hong Kong, for its financial support and to the CITES officials of China for their kind help. We also thank Yinbao Sun for his excellent illustration.

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A New Species of *Holcoglossum* (Orchidaceae) from China

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ABSTRACT. *Holcoglossum weixiense* X. H. Jin & S. C. Chen, a new species of Orchidaceae from Yunnan, China, is described and illustrated. It resembles morphologically *H. sinicum* Christenson and *H. flavescens*, but it can be distinguished from the former by having a transverse callus on the lip, a papillose spur, and a semi-orbicular mid-lobe, and from the latter by its pending habit, longer and semiterete leaves (more than 10 cm), and the semi-orbicular mid-lobe.

Key words: China, *Holcoglossum*, Orchidaceae.

Holcoglossum Schlechter (Orchidaceae) is distributed mainly in southwestern China, with a few species, e.g., *H. subulifolium* (Reichenbach f.) Christenson, extending to Laos, Thailand, Vietnam, and Malaysia. Because of its pollinia, three-lobed lip, and the short bifid rostellum, this genus is similar in floral structure to *Aerides*, *Papilionanthe*, and *Vanda*, from which several species have previously been transferred, e.g., *H. rupestre* (Handel-Mazzetti) Garay (1972), *H. flavescens* (Schlechter) Tsi (1982), and *H. subulifolium* (Reichenbach f.) Christenson (1987). Although Seidenfaden (1988) stated that it was difficult to define *Holcoglossum*, the new species somewhat coincides with Garay's (1972: 181) delimitation of the genus: ". . . characterized by the short, footless column with prominent wings. Clinandrium deeply cleft in front; rostellum short, bifid. Pollinia 2, notched, on linear, tapering stipes. Lip sessile with a slender, arcuate spur. Stem rather short, completely enclosed by distichously arranged leaf-sheaths. Leaves articulate, triquetrous or terete."

The new species was collected from the Langcan River in northwestern Yunnan. It is somewhat related to *Holcoglossum sinicum* Christenson and *H. flavescens* (Schlechter) Tsi, but is distinguished from the former by its semi-orbicular mid-lobe, papillose spur, notable callus on the labellum, and from the latter by its pending habit, longer and semiterete leaves (more than 10 cm), and the semi-orbicular mid-lobe.

Holcoglossum weixiense X. H. Jin & S. C. Chen, sp. nov. TYPE: China. Yunnan: Weixi, Langcan River, 21 May 2002 (fl), *H. K. Kadoorie Program Team 3490* (holotype, PE; isotypes [spirit], KUN, MO, PE). Figure 1.

Habitu *Holcoglosso sinico* subsimile, sed calcari intus papillato, inflorescentia caule longiore, labello medio callo notabili instructo bene differt.

Epiphytic plant, pendulous; root terete, thick, white; stem short, 1–2 cm long, enclosed by the leaf-sheathing bases. Leaves 20–30 × 1.5–2.5 cm, coriaceous, semiterete, channeled, articulate at base. Inflorescence lateral, erect, 3–4 cm long, 2- to 4-flowered, exceeding the stem, bracts ovate, 0.7 cm long. Flowers spreading, opening fully, white, tinged with pink; pedicel with ovary 2 cm long; dorsal sepal erect, ovate, 1 × 0.7 cm, 3-veined; lateral sepals oblique at base, seculate, 1.5 × 0.9 cm wide, 4-veined; petals spathulate, 1.1 × 0.6 cm, 3-veined; lip adnate to the column foot, fixed; three-lobed; lateral lobes triangular, erect, with purple streaks on the inner surface; mid-lobe semi-orbicular, entire, 1 × 1.2 cm, with a transverse callus at base toward the entrance of the spur; spur funnel-shaped, papillose, 0.7 cm long; column 0.4 cm long, column foot 0.1 cm long; pollinia 2, notched; stipes obcuneate, 3 mm long. Capsule unknown.

Distribution. China: Yunnan, Weixi, Bilou Snow Mountain, at 2300 to 2900 m, in evergreen forest.

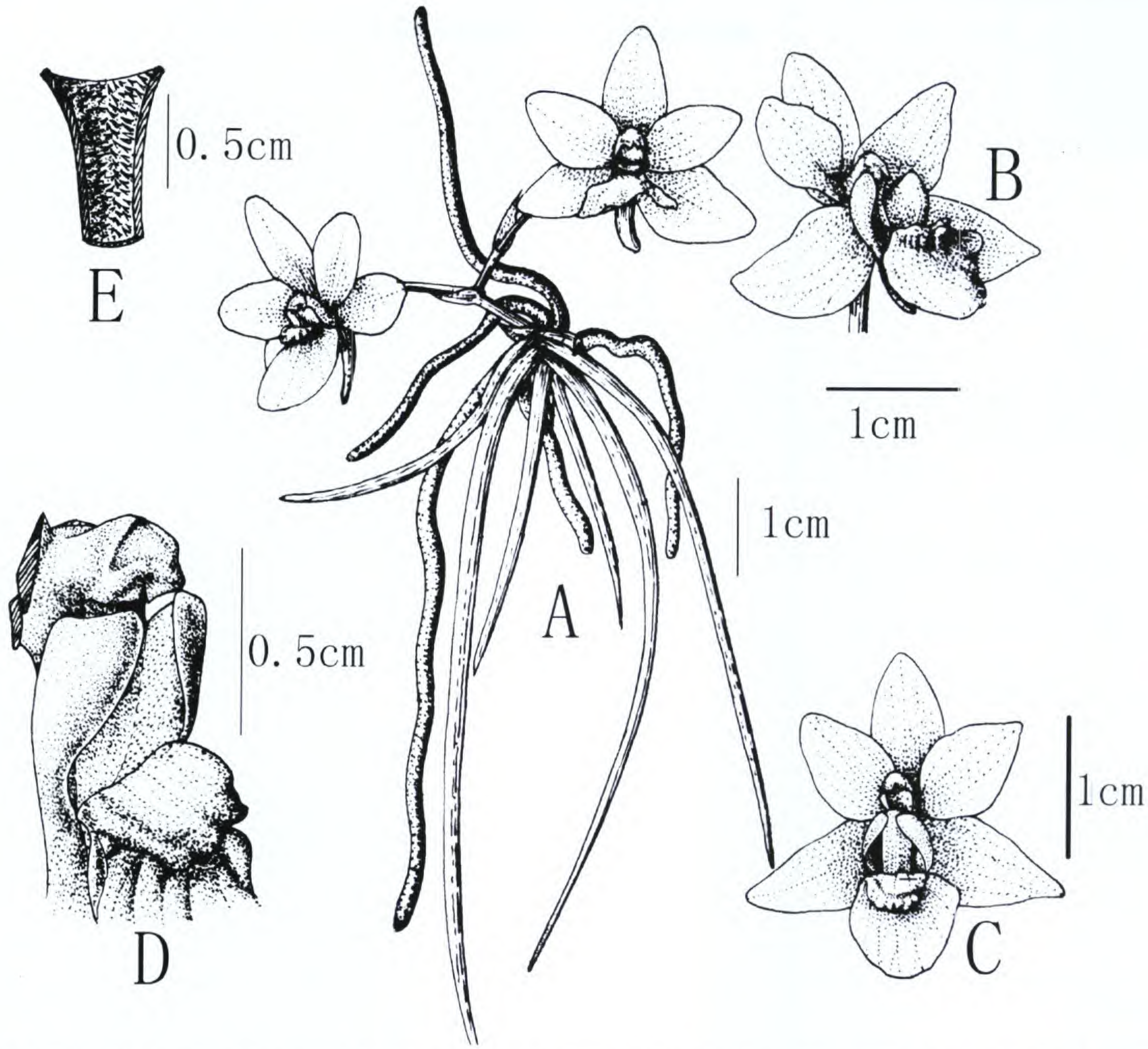

Figure 1. *Holcoglossum weixiense* X. H. Jin & S. C. Chen. —A. Habit and inflorescence. —B. Lateral view of flower. —C. Front view of flower. —D. Lateral view of lateral lobes. —E. Inner wall of spur. Drawn from the type specimen (*Hong Kong Kadoorie Program Team 3490*) by Yingbao Sun.

Paratypes. CHINA. **Yunnan:** Langcan River, 20 July 2001, *Hong Kong Kadoorie Program Team 1166* (KUN, PE), 21 May 2002 (fl), *Hong Kong Kadoorie Program Team 3486* (KUN), *3497* (PE).

Acknowledgments. We are indebted to Wen-tasi Wang for his critical reading of the manuscript, to the Kadoorie Farm and Botanic Garden, Hong Kong, for its financial support, and to the CITES officials of China for their kind help. We also thank Yinbao Sun for his excellent illustration.

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New Taxa of *Cimicifuga* (Ranunculaceae) from Korea and the United States

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ABSTRACT. A new species and a new variety of *Cimicifuga* (Ranunculaceae) are described and illustrated. *Cimicifuga austrokoreana*, restricted to south-central Korea, is distinguished from the other species of the genus by its strongly arcuate inflorescence axis, much shorter pedicels, and three bracteoles, one at the base and the other two at the middle of the pedicel. *Cimicifuga elata* var. *alpestris*, found in southern Oregon in the United States, is distinguished from variety *elata* and the other members of the genus by its sheathing scales surrounding the lower nodes of the stem.

Key words: *Cimicifuga*, Korea, Ranunculaceae, United States.

The genus *Cimicifuga* Wernischeck (Ranunculaceae) comprises as many as 22 species that are widely distributed in temperate regions of the Northern Hemisphere, including Europe, Asia, and North America; the center of diversity is in eastern Asia (Tamura, 1966, 1990, 1995; Ramsey, 1965, 1997; Compton et al., 1998). The plants of *Cimicifuga* are erect rhizomatous herbs with long-petioled, ternately compound leaves, racemose or paniculate inflorescences bearing many small flowers, and follicular fruits (Tamura, 1966, 1990, 1995; Park & Lee, 1995, 1996; Ramsey, 1965, 1997).

Classification of *Cimicifuga* and its related genera has been controversial. Compton et al. (1998) merged *Cimicifuga* and *Souliea* Franchet with *Actaea* L. mainly on the basis of the analyses of ITS and *trn*L-F sequences. However, Wang et al. (1999, 2001) argued that they are independent genera based on characters from morphology, palynology, and cytology. *Cimicifuga* is distinguished from *Actaea* in having three (rarely one) bracteoles, five sepals, staminode-like petals, one to eight pistils, follicular fruits, seeds with membranous scales on the surface, and more symmetric karyotypes without telocentric chromosomes. *Cimicifuga* is also distinguished from *Souliea* in having inflorescences with numerous flowers, caducous sepals, oblong to ovoid follicles, seeds with membranous scales on the surface, and mostly tricolpate pollen grains. In this study we follow the generic concept and delimitation of Tamura (1995) and Wang et al. (1999, 2001), in which *Cimicifuga* was recognized as a distinct genus.

During the course of a comprehensive systematic study on the genus *Cimicifuga*, a new species and a new variety were discovered from Korea and the United States, respectively. We describe these new taxa herein to make their names available for the *Flora of Korea* and other works in progress.

1. Cimicifuga austrokoreana H.-W. Lee & C.-W. Park, sp. nov. TYPE: Korea. Chungbuk: Youngdong-gun, Mt. Minjuji-san, Samdo-bong, Minimigol, 700 m, 19 Sep. 2000, *H.-W. Lee 1542* (holotype, SNU; isotypes, MO, SNU, TI). Figure 1.

Differt a *C. simplici* inflorescentiis axibus arcuatis, pedicellis multo brevibus et unibracteolatis basi.

Herbs perennial, hermaphroditic, 40–80 cm tall; rhizomes thick, 5–8 cm long, knotted, bearing fibrous roots; stem simple, erect, 1.5–4 mm thick, glabrous to sparsely pubescent with filiform unicellular trichomes. Leaves cauline, usually 3, alternate, 1- to 3-ternately compound, long-petioled; terminal leaflet broadly elliptic, 7.0–10.2 × 5.4–7.1 cm, 3-lobed, acuminate to cuspidate at tip, cuneate at base; both surfaces moderately to densely pubescent along major veins with filiform unicellular trichomes ca. 0.2 mm long; petiolules 1.5–2.5 cm long, grooved, sparsely to moderately pubescent with filiform unicellular trichomes; lateral leaflets similar to terminal one, but slightly smaller and inequilateral; petiole 10–20 cm long, grooved, sparsely to moderately pubescent with filiform unicellular trichomes. Inflorescence a terminal raceme, 10–20 cm long, often bearing 1 or 2 short

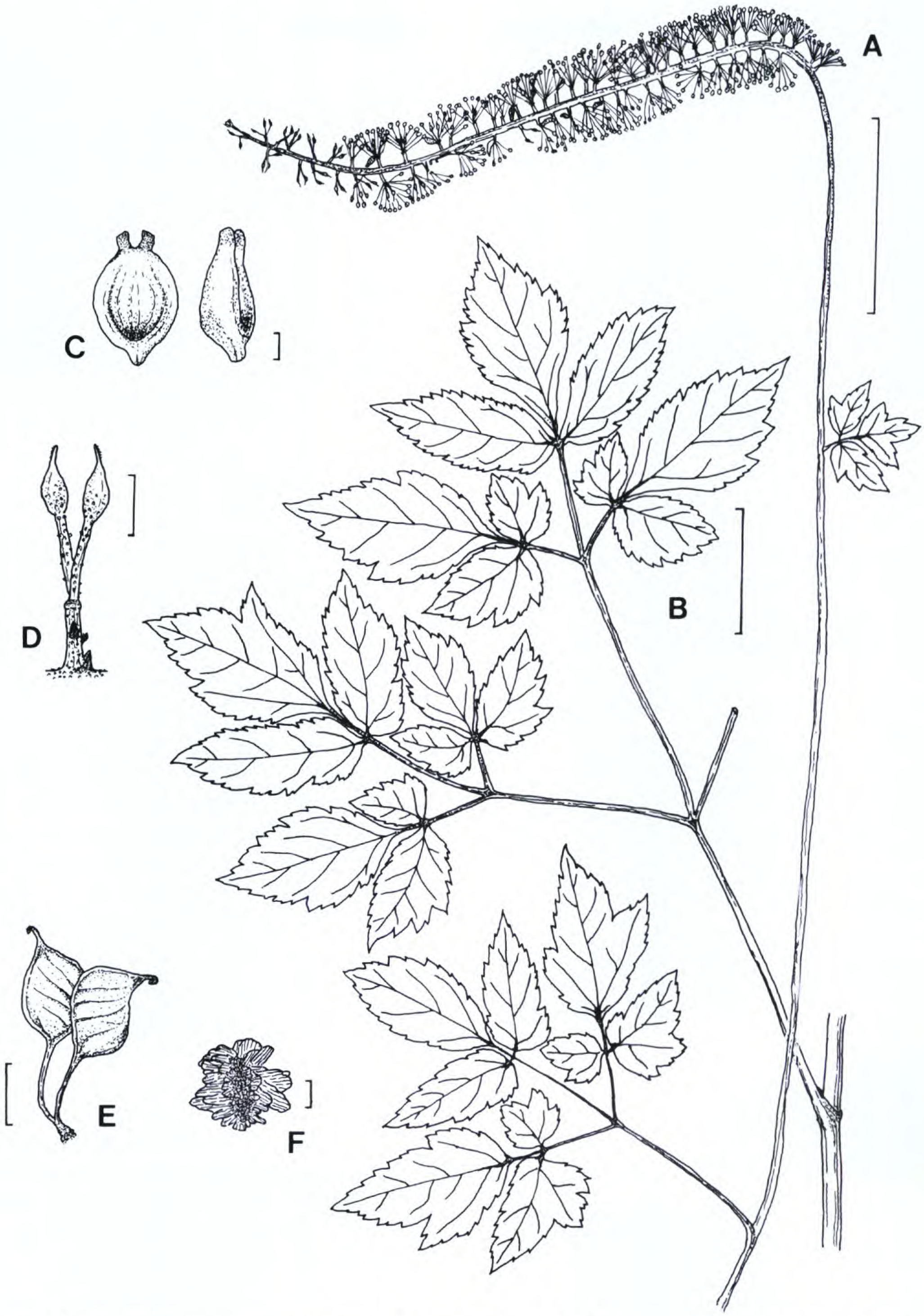

Figure 1. *Cimicifuga austrokoreana* H.-W. Lee & C.-W. Park. —A. Inflorescence and upper leaf. —B. Stem with lower leaf. —C. Petals. —D. Pistils and a pedicel with bracteoles. —E. Follicles. —F. Seed. Scale bars 5 cm (A, B), 5 mm (E), 2 mm (D), 1 mm (C, F). A–D, drawn from the holotype (*Lee 1542*, SNU), and E, F from the paratype (*Oh 1355*, SNU), by H.-W. Lee.

lateral branches near base, densely pubescent with saccate unicellular trichomes 0.1–0.2 mm long; inflorescence axis distinctly arcuate; pedicels very short, 1.0–2.5 mm long; bracteoles 3, 1 at base and 2 at middle of pedicel, triangular, 0.4–0.7 × 0.3–0.5 mm. Flowers bisexual, actinomorphic, small; sepals 5, petaloid, pale brown, broadly elliptic, concave, 3.5–4.8 × 2.8–3.5 mm; petal 1, broadly elliptic, 2.0–4.6 × 1.4–3.3 mm, bearing 2 small white appendages at tip, short-stipitate, nectariferous at base; stamens 18 to 27; filaments filiform, 5–8 mm long, slightly dilated upward; anthers bilocular, broadly oblong, 0.6 × 0.5 mm, basifixed, latrorsely dehiscent; pistils usually 2, rarely 1 or 3, elliptic to broadly elliptic, 1–3 × 0.7–2 mm, stipitate, sparsely pubescent with saccate unicellular trichomes ca. 0.1 mm long; style 1, slender, uncinate when mature, 0.8–1.7 mm long; stigma 1, minute, appressed to style. Follicles oblong, 5.5–9 × 4–6 mm, chartaceous, glabrous or sparsely pubescent with saccate unicellular trichomes; stipe 4–6 mm long; seeds 1 to 5 per follicle, elliptic, 2.2–2.6 × 1 mm, winged; wings ca. 1 mm long, chaffy, crenate.

Distribution. Restricted to high mountains of south-central Korea; moist, shady places along streamsides and mountain slopes of mixed deciduous forests, alt. 500 to 1000 m.

Phenology. Flowering mid-September to October (pers. obs.).

Cimicifuga austrokoreana is closely related to *C. simplex* (DC.) Turczaninow, but it clearly differs from the latter species by its strongly arcuate inflorescence axis, much shorter pedicels ca. 1.0–2.5 mm long, and three bracteoles, one at base and the other two at middle of pedicel (Fig. 1); in particular, the inflorescence axis is distinctly and consistently bent downward from the early stage of its development. *Cimicifuga simplex* has an erect, straight inflorescence axis, relatively long pedicels ca. 4–8 mm long, and bracteoles borne at the base of the pedicel.

In addition, the karyotypic study and allozyme analysis showed that *Cimicifuga austrokoreana* is genetically distinct from *C. simplex* (Lee & Park, 1998; Lee et al., 2000). Their karyotypes differ in the position of a secondary constriction on a pair of submetacentric chromosomes (Lee & Park, 1998), and populations of *C. austrokoreana* are distinguished from those of *C. simplex* by their allelic compositions at four loci (*Fe-3, Gdh, Lap,* and *Pgi-2*) and significantly low genetic identity values (mean = 0.688) (Lee et al., 2000).

Paratypes. KOREA. **Chunbuk:** Muju-gun, Mt. Deokyu-san, Baekryundam, 19 Sep. 1996, *Lee 771* (SNU). **Chungbuk:** Youngdong-gun, Mt. Minjuji-san, Samdobong, 29 Sep. 1995, *Lee 747, 748* (SNU), 8 Oct. 1995, *Lee 775, 776* (SNU). **Chunnam:** Gurye-gun, Mt. Chiri, Piagol, Sunyugyo, under deciduous forest, 24 Sep. 1990, *Hyun 5012* (SNU); Jilmaejae, 6 July 1995, *Lee 566, 567* (SNU), 18 Sep. 2000, *Lee 1541* (SNU), 30 Sep. 2000, *Lee 1543* (SNU); Simwon, ca. 4 km N of Nogodan, 19 Nov. 1995, *Lee 789, 790* (SNU); betw. Yuam waterfall & Jangteomok, 3 Oct. 1991, *Ryu s.n.* (SNU). **Kyungbuk:** Mt. Chiri, Cheonwang-bong, 5 Aug. 1939, *Col.? 14610* (SNU); Mt. Chiri, without specific locality, Aug. 1912, *Mori 161* (TI); Geumreung-gun, Mt. Hwanghak, near Jikji Temple, 19 Oct. 1993, *Oh 1355* (SNU [2]).

2. Cimicifuga elata Nuttall var. **alpestris** H.-W. Lee & C.-W. Park, var. nov. TYPE: U.S.A. Oregon: Jackson Co., Grizzly Peak, ca. 7 km NE of Ashland, partial shade under *Abies concolor,* 1 Sep. 1999, *H.-W. Lee 1516* (holotype, SNU; isotypes, DAV, OSU). Figure 2.

Affinis varietatis *elatae* et specierum affinium sed caulibus prope basin vaginatis ad nodos, foliolis supra pubescentibus in venis et pistillis numero 1–5 variantibus distincta.

Herbs perennial, hermaphroditic, robust, 1.0–1.6 m tall; rhizomes thick, 5–10 cm long, knotted, bearing fibrous roots; stem simple, erect, 1–1.5 cm thick, pubescent with 2- to 5-celled uniseriate trichomes 0.5–1 mm long, with scales near base; scales sheathing, usually 2, surrounding lower nodes of stem, lance-subulate, 4–6 × 1.5–2.5 cm. Leaves cauline, 3 to 5, alternate, 1- or 2-ternately compound, long-petioled; terminal leaflet broadly ovate to orbicular, 14–27 × 11–26 cm, palmately 5-lobed, acute to acuminate at tip, cordate at base; upper surfaces sparsely pubescent along major veins with multicellular uniseriate trichomes; lower surfaces densely pubescent with multicellular uniseriate trichomes; petiolules 7–14 cm long, grooved, densely pubescent with multicellular uniseriate trichomes; lateral leaflets similar to terminal one, but slightly smaller and inequilateral; petiole 10–17 cm long, grooved, densely pubescent with multicellular uniseriate trichomes. Inflorescence a few-branched terminal panicle, densely pubescent with 1- or 2-celled uniseriate trichomes 0.2–0.4 mm long; inflorescence axis erect; pedicels short, 1–4 mm long; bracteoles 3, at base of pedicel, middle one subulate, 1.5–4 × 0.5–1 mm, 2 lateral ones triangular and smaller. Flowers bisexual, actinomorphic, small; sepals 5, petaloid, pale brown, broadly elliptic, concave, ca. 3.5 × 2.5 mm; petal usually absent, rarely 1, elliptic, ca. 1 × 0.5 mm, bearing small white antheroid appendages at tip, long-stipitate, not nectariferous; stamens 20 to 30; filaments filiform, 3–5 mm long, slightly dilated

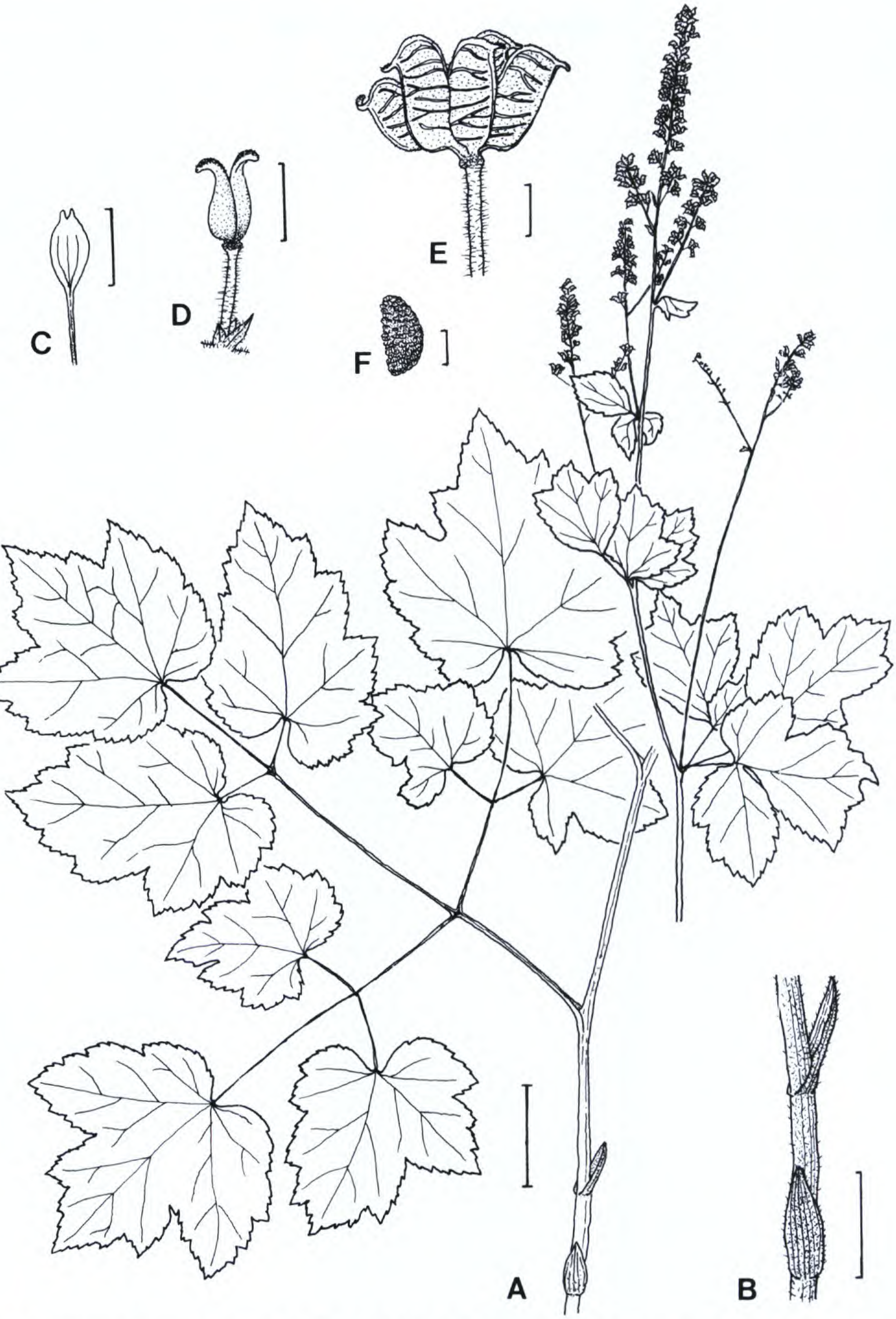

Figure 2. *Cimicifuga elata* var. *alpestris* H.-W. Lee & C.-W. Park. —A. Habit. —B. Stem with sheathing scales. —C. Petal. —D. Pistils and a pedicel with bracteoles. —E. Follicles. —F. Seed. Scale bars 10 cm (A), 5 cm (B), 5 mm (E), 2 mm (D), 1 mm (C, F). A, B, E, F drawn from the holotype (*Lee 1516*, SNU), and C, D from an isotype, by H.-W. Lee.

upward; anthers bilocular, broadly oblong, ca. 0.5 × 0.4 mm, basifixed, latrorsely dehiscent; pistils 1 to 5, elliptic to narrowly elliptic, 2.0–2.5 × 0.7–1.3 mm, sessile, densely pubescent with pyriform unicellular trichomes; style 1, short, stout, ca. 0.4 mm long; stigma 1, slightly expanded and recurved. Follicles elliptic, 7–11 × 4–5 mm, sessile, chartaceous, pubescent with pyriform unicellular trichomes; seeds 8 to 12 per follicle, triangular and lunate in outline, ca. 2.5 × 1.2 mm, transversely wrinkled.

Distribution. Restricted to southern Oregon of the United States; north- to northeast-facing mountain slopes, forest margins and trails in open or partially shaded places under *Abies concolor* (white fir), alt. 1300 to 1600 m.

Phenology. Flowering August to early September (pers. obs.).

Cimicifuga elata var. *alpestris* differs from variety *elata* as well as the other members of *Cimicifuga* in having sheathing scales surrounding the lower stem node. In addition, upper surfaces of the major leaf veins are pubescent with multicellular uniseriate trichomes in variety *alpestris*, and the new variety often has more pistils (one to five) as compared to variety *elata* (one or two).

Allozyme analysis indicated that populations of *Cimicifuga elata* var. *alpestris* have genetically diverged from those of variety *elata* (Lee & Park, in prep.). In addition, variety *alpestris* differs from variety *elata* in habitat preference; the latter usually grows in forests dominated by *Pseudotsuga menziesii* (Mirbel) Franco (douglas fir) and *Acer macrophyllum* Pursh at lower elevations (alt. 100 to 700 m).

Paratypes. U.S.A. **Oregon:** Jackson Co., 3 km E of Grizzly Peak, ca. 10 km NE of Ashland, N-facing slope along Shale City Road, open thickets, 1 Sep. 1999, *Lee 1519, 1520* (SNU).

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Pritchardia flynnii (Arecaceae), a New Endemic Species from Kaua'i, Hawaiian Islands

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ABSTRACT. *Pritchardia flynnii* Lorence & Gemmill is described and illustrated from Kaua'i, Hawai'i, U.S.A. This new species most closely resembles the Kaua'i endemic species *Pritchardia hardyi*, from which it differs by its shorter, more slender trunk 0.7–7(11) m tall and 10–20(30) cm DBH, erect to arcuate inflorescences equaling or slightly exceeding the petioles with lanate-tomentose, eventually glabrescent rachillae, and smaller fruits 25–35 × 18–23 mm when dry.

Key words: Arecaceae, Hawaiian Islands, Kaua'i, *Pritchardia*.

Pritchardia Seemann & Wendland (Arecaceae: Coryphoideae) comprises 28 currently recognized species restricted to the Hawaiian Islands, Tuamotu Archipelago, Cook Islands, Tonga, and Fiji (Gemmill, 1998). All but 5 of these species are restricted to the Hawaiian Islands (Uhl & Dransfield, 1987, 1999). All Hawaiian species are single-island endemics, many with highly restricted distributions, and many are listed as federally endangered or threatened. The genus was monographed by Beccari and Rock (1921), who recognized 32 species, 25 of these Hawaiian. Subsequently, Read and Hodel (1990) recognized 19 *Pritchardia* species in their treatment for the Hawaiian Islands, although they overlooked at least 2 additional validly published Hawaiian species: *P. lanaiensis* Beccari & Rock (Beccari & Rock, 1921) and *P. limahuliensis* H. St. John (St. John, 1988). An additional species, *P. perlmannii* Gemmill, was described from Kaua'i based on morphological (Gemmill, 1998) and molecular (Gemmill, unpublished) evidence. Recent collections and field studies have revealed the presence of yet another new species from the mountains of central Kaua'i, bringing the total of Hawaiian endemic *Pritchardia* species to 23.

Pritchardia flynnii Lorence & Gemmill, sp. nov. TYPE: Hawaiian Islands (U.S.A.). Kaua'i: Koloa District, Lihue–Koloa forest reserve, along ridge leading S from Mt. Kahili to La'auhiha'iai Peak, on E slope below summit, 2100–2200 ft. (640–671 m), 21°57.99′N, 159°29.70′W, 19 Oct. 1999, *D. Lorence, T. Flynn, M. H. Chapin, S. Perlman, J. Dransfield & S. Dransfield 8451* (holotype, PTBG; isotypes, MO, US). Figure 1.

Arbor usque ad 7(11) m; foliis 10–26, petiolis (31)35–61 cm longis lepidotis tomentosis basin versus, laminis 57–107 cm longis planis vel leviter undulatis (32)42–46(50)-segmentis, pagina abaxiali cum lepidibus densis ellipticis vel subcircularibus 0.4–0.8 mm longis; inflorescentia 58–88 cm longa; drupis ellipsoideis vel ovoideo-ellipsoideis, 22–25 × 15–16 mm in sicco.

Solitary palms, often with exposed roots at cylindrical base; trunk 0.7–7(11) m tall, 10–20(30) cm DBH, gray-brown, ringed with low leaf scars, longitudinally fissured. Crown symmetrical, with 10 to 26 leaves, leaf bases fibrous; petioles (31)35–61 cm long, about ½–¾ as long as leaf blade, 2.4–3 cm wide distally, 3.5–5 cm wide and densely woolly basally, the indument pale brown or tan in color, densely lepidote throughout length and eventually glabrate, or scales persisting along margins and extending abaxially onto leaf ribs, adaxial hastula short, 3–4 cm wide, broadly rounded to truncate, often oblique, margin entire or shortly apiculate; blade costapalmate, with (32)42 to 46(50) segments, central portion of blade plane or slightly concave, rigid, nearly plane to somewhat undulate, 57–107 cm long from tip of hastula to apex of median segment, the segments 2–2.9 cm wide, the sinuses ¼–⅓ length of the blade, the tips stiff or lax with age, deeply bifid, the adaxial blade surface glabrous, the abaxial surface uniformly densely appressed tomentose-lepidote, the scales subcircular to elliptic, 0.4–0.8 mm long, usually matted and

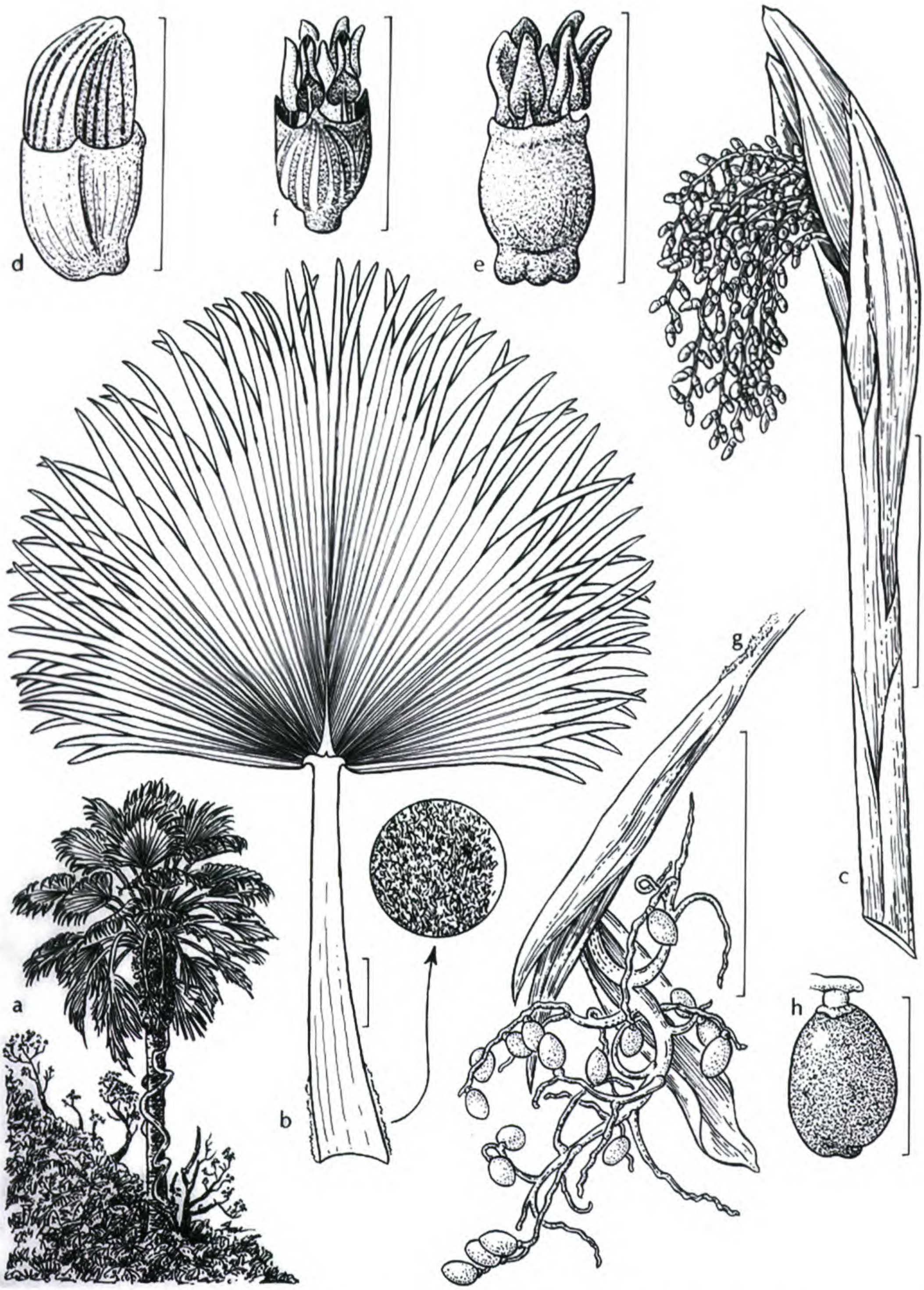

Figure 1. *Pritchardia flynnii* Lorence & Gemmill. —a. Habit. —b. Leaf, adaxial surface, with inset showing dense woolly indument at base of petiole. —c. Inflorescence in bud showing prophyll and peduncular bracts. —d. Dried flower in bud with connate petals. —e. Fresh flower. —f. Dried flower. Both e and f with petals fallen. —g. Infructescence. —h. Mature fruit. a, drawn from unvouchered individual growing along Wahiawa Stream; b, g, h from *Lorence & Stone 8380*; c–f, from *Lorence & Stone 8385*. Scale bar 10 cm in b, c; 7 mm in d, e; 6 mm in f; 7.5 cm in g; 2.5 cm in h.

felt-like, pale brown or gray. Inflorescences 1 or occasionally 2 per leaf axil, in flower erect or arcuate, 58–88 cm long, equaling or generally exceeding petiole and reaching ½ (rarely ¾) length of blade, in fruit 80–100 cm long, erect to arcuate and slightly shorter to slightly longer than the blade; prophyll externally brown or tan lepidote, tomentose basally, disintegrating; peduncular bracts 4, overlapping, eventually disintegrating, externally uniformly brown or tan tomentose, denser basally; peduncle 48–60 cm long, 8–11 mm diam., terete or compressed, brown lanate-tomentose; panicle branched to second degree, the floriferous portion 11–20 cm long, the basal branches 10–13 cm long with 3 or 4 rachillae, the middle branches with a single bifurcate branch of 2 rachillae or less commonly unbranched, apical portion of rachis with 9 to 11 unbranched rachillae, these sinuous in flower, 6–11 cm long, at first sparsely to densely lanate-tomentose, in fruit 10–14 cm long, tomentose or glabrescent; floral bracts subulate-filiform, 1.5–3 mm, brown. Flowers spirally arranged, 8–10 mm long in bud, glabrous, calyx plus pedicel 3–5 mm long, calyx cupular, 1.5–2.5 mm wide at base, 3–4 mm wide at rim of cup, green when fresh, when dry with prominulous nerves converging in abruptly acuminate teeth 0.3–0.8 mm long; petals 5.7–7 × 2.8–3.5 mm, acute to acuminate at apex, yellow when fresh, veins prominulous when dry; staminal cup 3.5–6 mm long, exserted beyond calyx rim, deep orange-yellow when fresh; filaments 1–2 mm long, anthers 3–5 mm long; pistil 5–6.5 mm long, including style 3–4 mm long; style present in fruit, ca. 2 mm long. Fruit ellipsoid or ovoid-ellipsoid, 25–35 × 18–23 mm when fresh, 22–25 × 15–16 mm when dry, often slightly asymmetrical or acentric, with persistent calyx and corolla at base and accrescent style at apex, smooth, glabrous, shiny dark green, ripening purplish black; seed ovoid-ellipsoid, 14–18 × 9–12 mm.

Distribution. Known from south-central to north-central Kaua'i. Populations are known from the Wahiawa Drainage (Wahiawa Stream and Mountains and Mt. Kahili) in the south, the north fork of the Wailua River ("Blue Hole"), Makaleha Mountains, Power Line Trail, and Wainiha Valley in the north. Intervening areas likely harbor additional plants, in effect linking these known populations.

Habitat. This new species occurs from approximately 488 to 890 m elevation, usually on moderate to steep slopes in low-stature lowland wet forest, shrubland, or herbland usually dominated by *Metrosideros polymorpha* Gaudichaud, *M. waialealae* (Rock) Rock var. *waialealae*, and *Dicranopteris linearis* (Burmann) Underwood. Other associates include *Antidesma platyphyllum* H. Mann var. *hillebrandii* Pax & K. Hoffmann, *Bobea elatior* Gaudichaud, *Diospyros sandwicensis* (A. DC.) Fosberg, *Freycinetia arborea* Gaudichaud, *Ilex anomala* Hooker & Arnott, *Machaerina angustifolia* (Gaudichaud) T. Koyama, *Melicope, Syzygium sandwicensis* (A. Gray) Niedenzu, and species of *Cibotium, Cyanea, Cyrtandra, Myrsine, Psychotria, Scaevola,* and *Tetraplasandra.* Weedy alien species invading this habitat include *Psidium cattleianum* Sabine var. *cattleianum* and *Melastoma candidum* D. Don, both of which pose a significant threat to native plant communities in the vicinity (Lorence & Flynn, unpublished), and a variety of alien grasses including *Paspalum conjugatum* Bergius, *Setaria gracilis* Kunth, and *Schizachyrium condensatum* (Kunth) Nees.

Population size and conservation status. This species occurs as scattered individuals and small groves throughout the Wahiawa Drainage area, where the population size is estimated at 250 to 300 individuals. Additional populations are known from: the ridge between Mt. La'auhiha'ihai and Mt. Kahili (6 individuals), the Blue Hole (exact number unknown), Power Line Trail (8), the Makaleha Mts. (84), and Wainiha Valley (exact number unknown), bringing the total to perhaps 350 to 400 plants.

Plants of different size classes including occasional juveniles are represented in some localities, suggesting at least limited regeneration is taking place. However, invasive weedy alien plant species, notably *Psidium cattleianum* Sabine and *Melastoma candidum* D. Don and aggressive grasses, threaten this species (Lorence & Flynn, unpublished). Additional threats are posed by feral animals including feral pigs (*Sus scrofa*) and the Polynesian rat (*Rattus exulans*), a known seed predator that adversely impacts regeneration of the Hawaiian *Pritchardia* species (Cuddihy & Stone, 1990). Feral pigs are present in many areas inhabited by this species and may destroy seedlings and increase opportunities for alien plants to invade through degradation of the habitat. Based on its relatively low population status, presence of threats, and low regeneration, we suggest this new species should be considered for threatened status.

Etymology. We are pleased to name this new species for one of its initial collectors, Timothy W. Flynn, in recognition of his extensive botanical collections and contributions to our knowledge of the Hawaiian flora.

Affinities. Among the Kaua'i species, *Pritchardia flynnii* resembles *P. hardyi* Rock, which is also characterized by abaxially densely gray tomentose-

lepidote leaves. This latter species differs by its stouter trunk 4–8 m tall and 30–45 cm diam., inflorescences equal to or often exceeding the leaves with minutely villous rachillae, and long-drooping infructescences with larger fruits 20–35(40) × 16–25 mm when dry.

Pritchardia flynnii is distinguished from its Kaua'i congeners by the following combination of features: short stature with trunk 0.7–7(11) m tall; relatively small crown with only 10 to 26 leaves; leaf blades relatively small, 57–107 cm long, nearly plane to slightly undulate and abaxially densely appressed tomentose-lepidote; relatively small inflorescences branched to the second degree, reaching ½ (rarely ¾) length of blade in flower and often reaching the blade apex in fruit; fruits smooth, ellipsoid or ovoid-ellipsoid.

Several collections from the Makaleha Mountains (*Lorence & Flynn 7424*, PTBG; *Perlman & Wood 16260*) differ in having leaf blades that are abaxially sparsely scattered lepidote, but these specimens are otherwise referable to *P. flynnii*. The comparatively sparse foliar pubescence may be due to leaf age or weathering, or it may be genetically controlled. This variant will key out under 8b in the key below.

Seven endemic *Pritchardia* species including *P. flynnii* occur on Kaua'i, and two Pacific species are commonly cultivated there (*P. pacifica* Seemann & H. Wendland and *P. thurstonii* F. Mueller & Drude). In order to successfully key out these palms complete material is required including flowers, fruits, and leaves. In addition, the number of leaves per crown, relative lengths and positions of leaves, inflorescences, and infructescences should be noted and photographed when making herbarium specimens. With adequate herbarium material available, the native Kaua'i species generally can be separated by the following key, which was adapted in part from Gemmill (1998) and Read and Hodel (1990). Measurements are based on dried herbarium specimens.

KEY TO THE ENDEMIC SPECIES OF *PRITCHARDIA* IN KAUA'I, HAWAI'I

1a. Inflorescences nearly equal to or exceeding leaf blades in flower; infructescences usually extending well beyond the blade apex and generally pendulous . . . . . *P. hardyi*

1b. Inflorescences shorter than petioles or reaching ½ (rarely ¾) length of leaf blade; infructescences shorter than or equaling but not exceeding the blade apex, erect, arcuate, or pendulous.

2a. Leaf blades abaxially densely silvery to pale brown or golden, appressed lepidote-tomentose, the scales and hairs matted and obscuring the blade surface.

3a. Inflorescence rachillae densely floccose-lanate at least when young, becoming glabrate with age . . . . . *P. minor*

3b. Inflorescence rachillae glabrous or sparsely to densely velutinous-tomentose when young and soon glabrescent.

4a. Inflorescence rachillae glabrous, viscous with varnish-like resinous coating; flowers and buds shiny, viscous-resinous; fruit 33–35 mm long . . . . . *P. viscosa*

4b. Inflorescence rachillae velutinous-tomentose or glabrescent, not viscous or resinous; flowers and buds dull, not shiny and viscous; fruit 22–25 mm long . . . . . *P. flynnii*

2b. Leaf blades abaxially with scattered to closely arranged scales and hairs, but these not obscuring the blade surface.

5a. Large palms, up to 20 m tall; trunk large and stout, 50 cm or more DBH; crown with more than 40 leaves; leaf blades waxy or glaucous pale green . . . . . *P. waialealeana*

5b. Moderate- to small-sized palms, less than 10 m tall; trunk moderate to slender, much less than 50 cm DBH; crown with less than 30 leaves; leaf blades plain green.

6a. Leaves with petioles 96–170 cm long; fruit 30–38 × 18—21 mm . . . . . *P. perlmanii*

6b. Leaves with petioles (31)35–90 cm long; fruit 18–28 × 12–21 mm.

7a. Abaxial surface of blade with lepidia 0.2–0.3 mm long; flowers with calyx + pedicel 1.8–3 mm; petals 3–3.5 mm . . . . . *P. napaliensis*

7b. Abaxial surface of blade with lepidia 0.4–1.5 mm long; flowers with calyx + pedicel 2.5–5 mm; petals 4.5–7 mm.

8a. Rachillae glabrous; floral bracts scarious, ovate-triangular, 0.5–1.5 mm; calyx + pedicel 2.5–3 mm; petals 4.5–5 mm . . . . . *P. limahuliensis*

8b. Rachillae sparsely to densely velutinous-tomentose when young, often glabrescent; floral bracts stiff, subulate-filiform, 1.5–3 mm; calyx + pedicel 3–5 mm; petals 5.7–7 mm . . . . . *P. flynnii* (Makaleha Mountains collections)

Paratypes. HAWAIIAN ISLANDS (U.S.A.). **Kaua'i:** Koloa District, Lihue–Koloa forest reserve, Wahiawa Stream & Mtns., along steep N–S-facing ridge from stream towards Kapalaoa Peak, *Lorence et al. 6655* (PTBG, US); Wahiawa Mtns. S of Kapalaoa, along main Wahiawa Stream, *Lorence & Stone 8380* (PTBG, US), *8385* (PTBG); headwaters of Wahiawa Stream, *Wood et al. 238* (PTBG); first N fork of Wahiawa Stream, NW of Wahiawa Bog,

Flynn et al. 2931 (PTBG); Wahiawa Drainage below Kapalaoa, *Wood 7466* (PTBG); trail from Kahili Mtn. Park watertank along spine of secondary ridge betwn La'auhaihai & Kahili, *Flynn & Nishek 6496* (PTBG), *Chapin et al. 57* (K, PTBG); border of Lihue and Kawaihau Districts, headwaters of N fork of Wailua River, area called "Blue Hole" below Mts. Waialeale and Kawaikini, *Lorence et al. 5400* (PTBG); Kawaihau District, Kealia forest reserve, Makaleha Mtns., *Lorence et al. 7413* (PTBG); between Pu'u Eu & Leleiwi, 840–890 m, 14 July 1993, *Wood et al. 2675* (PTBG); betwn. Malamalama & Leleiwi, *Wood et al. 2501* (PTBG); SSE of Mt. Namahana, *Wood & Perlman 7304* (PTBG); slopes S of Mt. Kekoiki & Mt. Namahana, drainages of Anahola Stream, *Perlman & Wood 16260* (PTBG); border betwn. Hanalei & Kawaihau Districts, Power Line Trail, *Chapin 76* (PTBG); Hanalei District, Wainiha Valley, back of valley below Hinalele Falls, *Wood et al. 2347* (PTBG); W side of Wainiha Valley, 2000 ft. (607 m) N of Pali Eleele, *Christensen & Robinson 289* (BISH, PTBG).

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Una Nueva Especie de *Eleocharis* (Cyperaceae) del Perú

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Resumen. Se describe una nueva especie del género *Eleocharis* (Cyperaceae) para el Perú. Se presenta un cuadro comparativo con dos especies afines: *E. dombeyana* Kunth y *E. montevidensis* Kunth.

Abstract. A new species of the genus *Eleocharis* (Cyperaceae) is described for the Peruvian flora. A table of comparative characteristics with two related species is presented: *E. dombeyana* Kunth and *E. montevidensis* Kunth.

Key words: Cyperaceae, *Eleocharis*, Peru.

Durante el estudio del género *Eleocharis* R. Brown para el proyecto *Flora del Paraguay*, se ha examinado la colección general del género del Missouri Botanical Garden (MO). Dentro de ésta se ha encontrado *E. grossimucronata*, una especie nueva para Perú.

Eleocharis grossimucronata F. Mereles, sp. nov. TIPO: Perú. Contumazá: Cajamarca, Yetón (San Benito-Guzmango), 12 Junio 1983, *A. Sagástegui & S. López M. 10553* (holótipo, MO). Figura 1.

Herba perennis, caespitosa; culmis teretis, striatis, erectis, 13–20 cm altis, 0.5–0.6 mm crassis. Vaginae foliares truncatae, mucronatae. Spicula oblonga, acuta; gluma amplexicauli; glumis margine hyalinis, superioribus apice acutis, inferioribus apice rotundatis; staminibus 2 vel 3; stylo trifido. Achaenium 0.9–1 mm longum (cum styli basi), 0.3–0.4 mm latum, obovoideum, trigonum, angulis prominentibus, reticulatum; rostro depresse subconico, apice truncato, fusconigrescente.

Hierba palustre, cespitosa, perenne, rizomatosa; rizoma cubierto por una membrana de color pardo-sanguíneo; raíz fibrosa; tallos de 13–20 cm de altura, teretes, huecos y con estrías longitudinales de 0.5–0.6 mm de diámetro. Vaina inferior herbácea, de ápice oblícuo, de color rojo sangíneo; vaina superior de color pajizo y punteada de rojo, truncada horizontalmente, espesada en los bordes con puntos rojos y provista de un mucrón bien desarrollado de 0.7–1 mm de largo. Espiguillas pardo-negruzcas, oval-oblongas, de 5–7 × 3 mm, con numerosas flores, el ápice obtuso o redondeado. Glumas de 1.5 × 0.5 mm, la nervadura central de color pajizo-rojizo, pardo negruzco a los lados, los margenes hialinos, de ápice agudo las superiores y obtuso-redondeado las inferiores, la inferior estéril, amplexicaule. Flores hermafroditas; estambres 2 ó 3, levemente exertos, anteras mucronadas; estilo 3-fido. Aquenios obovoides, trígonos, de 0.9–1 mm (con el rostro) × 0.3–0.4 mm, los ángulos espesados, la base angostada, el ápice terminado en una corona de donde emerge el rostro, verde parduzcos o amarillentos y cuando muy maduros, negruzcos, opacos, la superficie reticulada; rostro deprimido de color pardo negruzco, sub-cónico, truncado en el ápice, rugoso; setas perigonales 4–5, levemente espinuladas, más cortas que el aquenio.

Fenología. Fructifica en junio.

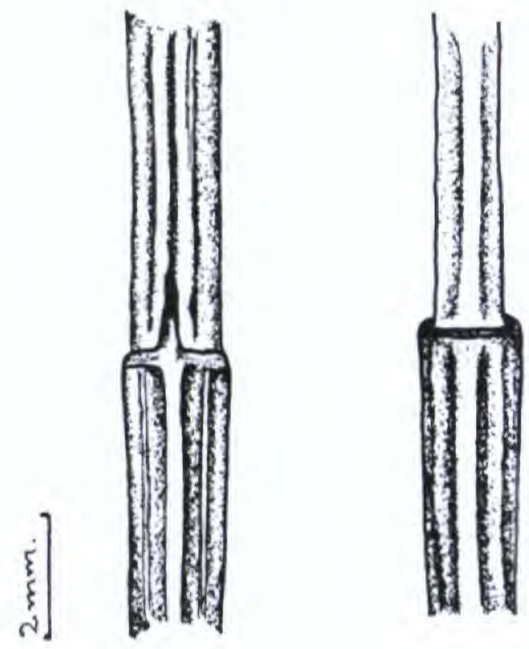
Hábitat y distribución geográfica. Crece en suelos anegadizos, fangosos y áreas inundables en general; fue hallada a 1800 m.s.n.m. Solo se conoce la localidad del tipo, en Perú; probablemente también en las provincias andinas de Ecuador y Bolivia.

Eleocharis grossimucronata, por los caracteres de su vaina truncada y del aquenio, pertenece a la serie *Eleocharis*, subserie *Truncatae* Svenson (1929) (González-Elizondo & Peterson (1997: 439)), presentando alguna similitud con *E. dombeyana* Kunth. De acuerdo con McVaugh (1993: 362), *E. dombeyana* Kunth es muy similar a *E. montevidensis* Kunth por lo que en la Tabla 1 se presenta una comparación entre estas especies, basada en las transcripciones de Kunth in Barros (1947: 172–173) y las descripciones de Svenson (1939: 68–71).

Etimología. El epíteto *Eleocharis grossimucronata* se debe al tamaño bastante largo del mucrón presente en la vaina superior.

Agradecimientos. A la Beca Elizabeth E. Bascom para Botánicas Latinoamericanas, otorgada por el Missouri Botanical Garden, por los subsidios para los estudios en el género *Eleocharis*; a Gerrit Davidse por la corrección del manuscrito y a Roy Gereau por la corrección de la diagnosis latina.

A



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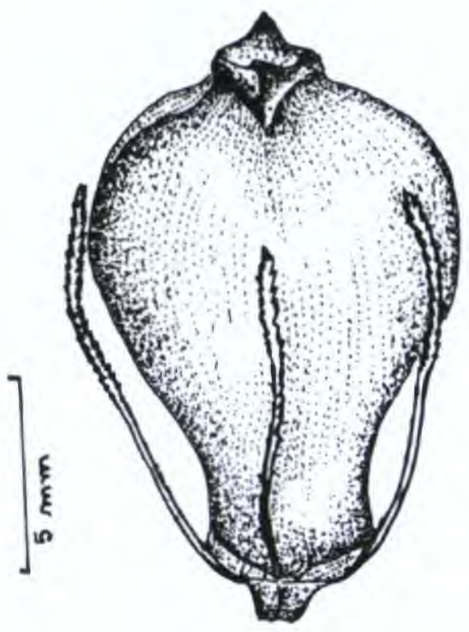

D

Figura 1. *Eleocharis grossimucronata* F. Mereles. —A. Planta. —B. Vaina superior. —C. Espiguilla. —D. Aquenio. Holótipo, *Sagástegui & López 10553* (MO).

Table 1. Comparación morfológica entre *Eleocharis grossimucronata*, *E. dombeyana* y *E. montevidensis*.

Caracteres	*E. grossimucronata*	*E. dombeyana*	*E. montevidensis*
Vaina superior	mucronada	mucronada	alargada
Glumas fértiles	lisas, ápice agudo	escariosas, ápice redondeado	elípticas, ápice redondeado
Aquenio:			
Tamaño (mm)	0.9–1 (con rostro)	1.6 (con rostro)	1.5 (con rostro)
Forma	obovada, trígona	trígona	obovoide
Ángulos	espesados	romos	romos
Color	negro opaco	amarillo oro	amarillo herrumbroso
Superficie	reticulada	lisa	puntuada
Rostro	deprimido, achatado	subulado	subulado
Largo del rostro (mm)	0.01	0.3	0.2
Setas perigonales	4–5	6	5–6

Literatura Citada

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Una Nueva Especie de *Eleocharis* (Cyperaceae) para Venezuela

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RESUMEN. Se describe una nueva especie del género *Eleocharis* (Cyperaceae) para la flora de Venezuela; se presenta en una tabla la separación de los caracteres con dos especies afines: *E. schaffneri* Boeckeler y *E. intricata* Kükenthal.

ABSTRACT. A new species of the genus *Eleocharis* (Cyperaceae) is described for the Venezuelan flora. A table is presented with comparative characteristics for two related species: *E. shaffneri* Boeckeler and *E. intricata* Kükenthal.

Key words: Cyperaceae, *Eleocharis*, Venezuela.

Con motivo del estudio del género *Eleocharis* R. Brown para el proyecto *Flora del Paraguay*, se ha revisado la colección general de *Eleocharis* y encontrado *E. rojasiana*, una especie nueva de la familia Cyperaceae para Venezuela.

Eleocharis rojasiana F. Mereles, sp. nov. TIPO: Venezuela. Territorio Federal Amazonas: Departamento Atabapo, Río Ocamo, alrededor del raudal Arata, 03°03′N, 67°20′W, enero 1990, *A. Fernández 6655* (holótipo, MO). Figura 1.

Herba rhizomatoza; culmis quadrangulatis, 4–8 cm altis, 0.1–0.2 mm. Vagina foliaris hyalina. Spicula ovata, obtusata, 5 vel 6 flora, 2–3 mm longa, 1–1.2 mm lata; glumis confertim imbricatis, apice obtusa, superioribus apice acutis. Achaenium ca. 0.8 mm longum (sine styli basi), 0.8–0.85 mm latum, biconvexum, olivaceum, basi rotundatum; rostro conico, 0.1–0.2 mm longo, basi crasso, atrofusco, secus latera convexa percurrente.

Hierba rizomatoza, perenne, cespitosa; raíces fibrosas; tallos de 4–8 cm de altura × 0.1–0.2 mm de ancho, oscuramente cuadrangulares, estriados, angulosos. Vaina superior membranosa, hialina, de boca laxa, dilatada. Espiguillas de 2–3 × 1–1.2 mm, ovoides, obtusas, con 5–6 flores. Glumas de 1.8–2 × 0.5 mm, membranáceas, muy imbricadas con un nervio central desarrollado, verde pajizo y levemente parduzco a los lados, sin márgenes hialinos, las inferiores de ápice redondeado a obtuso, las superiores de ápice agudo. Flores hermafroditas; estambres 1, anteras de 0.8 mm de largo; estilo bífido, levemente exerto hacia el ápice. Aquenios de 0.8 mm (sin el rostro) × 0.8–0.85 mm, biconvexos, base redondeada, superficie levemente reticulada, verdosos; rostro de 0.1–0.2 mm de largo, cónico de base ancha, incumbente sobre las caras convexas del aquenio, pardo oscuro; setas perigonales 6, amarillo parduzcas, brevemente escabrosas, más cortas o iguales que el aquenio.

Fenología. Fructifica en el mes de enero.

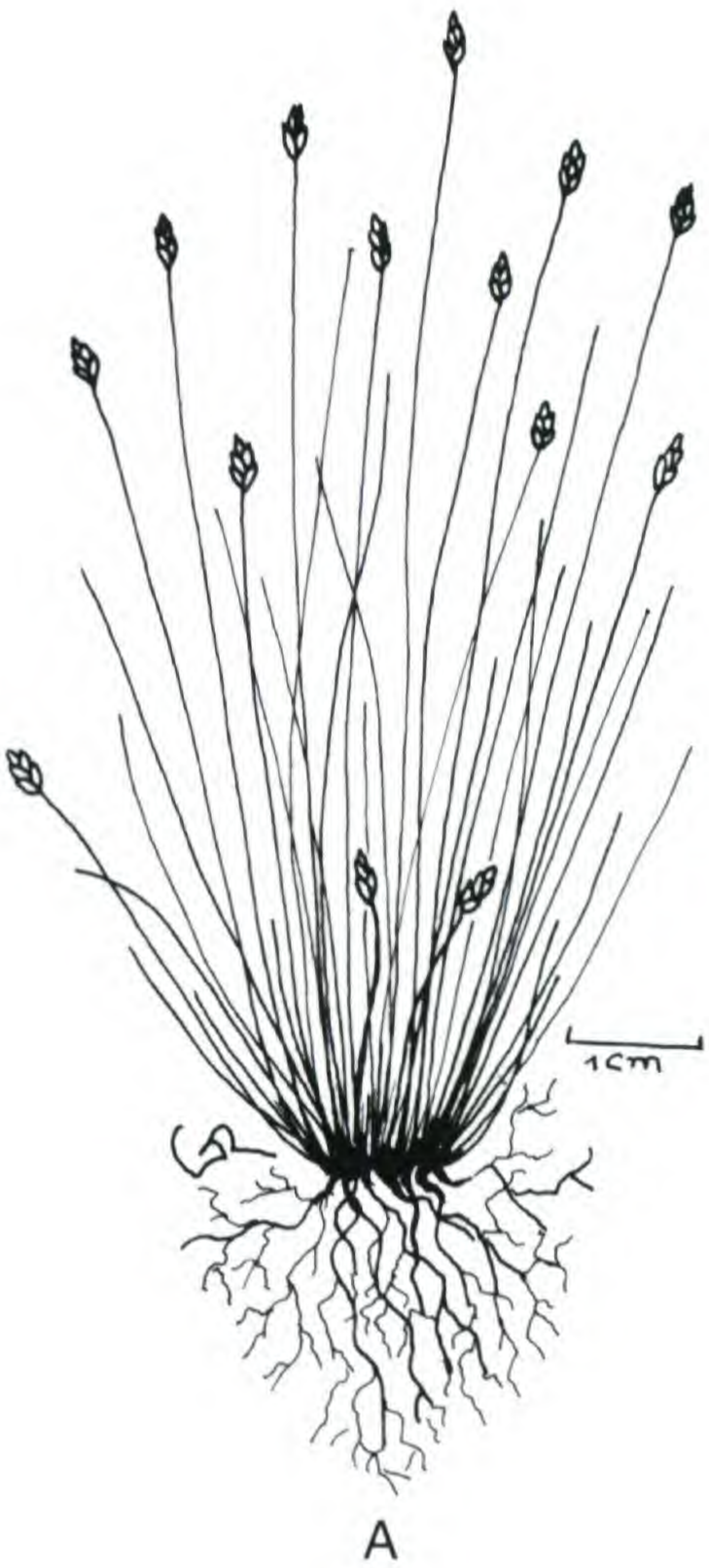
Hábitat y distribución geográfica. Crece en sitios húmedos, inundables y orillas de cursos de agua; fue encontrada a 270 m.s.n.m. Se conoce únicamente de la localidad del tipo.

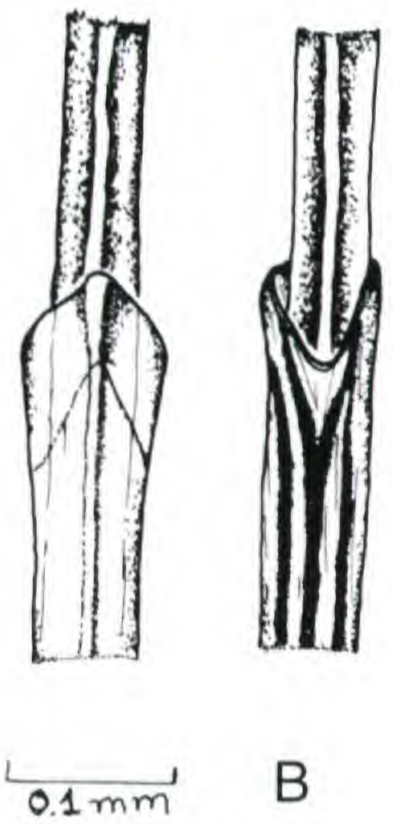
Eleocharis rojasiana presenta alguna similitud con *E. schaffnerii* y con *E. intricata*. En la Tabla 1 se presenta la diferenciación entre las especies, basada en la transcripción de Svenson (1929: 128).

Eleocharis rojasiana puede considerarse como integrante del subgen. *Eleocharis*, serie *Maculosae* Svenson (1929), subserie *Ocreatae* (C. B. Clarke) Svenson (1929) (González-Elizondo & Peterson (1997)), por las siguientes características: la forma y el color del aquenio y la forma y consistencia de la vaina superior. Lamentablemente se conoce solamente un ejemplar, el que considero válido para la descripción de la especie mencionada puesto que la misma se presenta muy clara. Sin embargo, esta especie podrá preceder a una documentación adicional respecto de su distribución en Venezuela como fuera de este país.

Etimología. El epíteto *Eleocharis rojasiana* está dedicado a la memoria de Teodoro Rojas, primer botánico paraguayo quien colectó junto a E. Hassler, siendo sus colecciones pioneras para Paraguay y declaradas de interés en el Museo de Ciencias Naturales de Tucumán, Argentina.

Agradecimientos. La autora agradece a la Beca Elizabeth E. Bascom para Botánicas Latinoamericanas, otorgada por el Missouri Botanical Garden, por los subsidios aportados para la realización de los estudios en el género *Eleocharis*. A Gerrit Da-





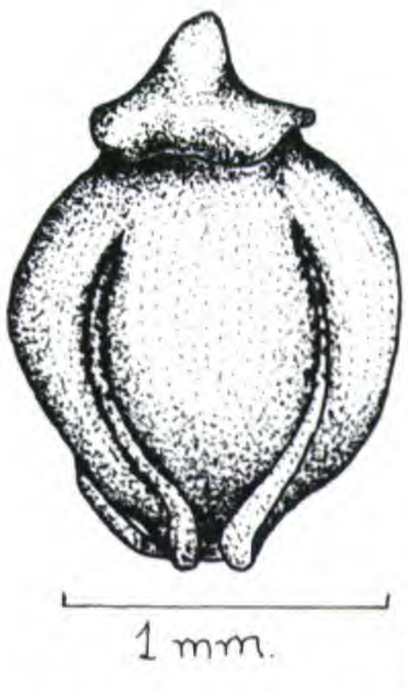


Figura 1. *Eleocharis rojasiana* F. Mereles. —A. Aspecto de la planta. —B. Vaina superior. —C. Espiguillas. —D. Aquenio. Holótipo, *Fernández 6655* (MO).

vidse y Roy Gereau por la corrección del manuscrito y la diagnosis latina respectivamente.

Literatura Citada

González-Elizondo, M. S. & P. M. Peterson. 1997. A classification of and key to supraspecific taxa in *Eleocharis* (Cyperaceae). Taxon 46: 442–443.

Svenson, H. K. 1929. Monographic studies in the genus *Eleocharis*. Rhodora 31: 128.

Table 1. Diferenciación entre *Eleocharis rojasiana*, *E. schaffneri* y *E. intricata*.

Caracteres	*E. rojasiana*	*E. schaffneri*	*E. intricata*
Espiguilla	hasta 6 flores	7–15 flores	8–9 flores
Glumas	muy imbricadas, sin márgenes hialinos	laxas, con márgenes hialinos	laxas, con márgenes hialinos
Aquenio	verde, superficie reticulada, base redondeada	blanco-grisáceo, superficie estriada, base angostada	negruzco, superficie lisa, base contractada

The Genus *Physaria* (Brassicaceae) in South America

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ABSTRACT. Three new Argentinian species of *Physaria, P. crassistigma, P. lateralis,* and *P. pygmaea,* are described and illustrated. The new combinations *P. mendocina* and *P. urbaniana* are proposed. A key to the five South American species of *Physaria* is given. Brief comments are presented on the disjunction of these South American species and their relationships to their North American relatives.

RESUMEN. Se describen e ilustran tres especies argentinas de *Physaria, P. crassistigma, P. lateralis* y *P. pygmaea.* Se proponen dos nuevas combinaciones: *P. mendocina* y *P. urbaniana.* Se provee una clave para las cinco especies de *Physaria* sudamericanas. Se presentan comentarios breves acerca de la disyunción de estas especies sudamericanas y de los parentescos con sus parientes norteamericanos.

Key words: Argentina, Brassicaceae, *Lesquerella, Physaria,* South America.

As delimited herein, the genus *Physaria* (Nuttall ex Torrey & A. Gray) A. Gray includes all except eight species previously recognized by various authors in *Lesquerella* S. Watson (e.g., Rollins & Shaw, 1973; Rollins, 1993, 1995; Rollins et al., 1996; Anderson et al., 1997; O'Kane, 1999). For detailed discussions justifying the reduction of *Lesquerella* to synonymy of *Physaria,* see O'Kane et al. (1999) and Al-Shehbaz and O'Kane (2002). The eight auriculate-leaved species previously recognized in *Lesquerella* are now treated in the genus *Paysonia* O'Kane & Al-Shehbaz (O'Kane & Al-Shehbaz, 2002). Although members of *Physaria* in North America have been the subject of several monographic treatments (Payson, 1921; Rollins, 1939, 1993; Rollins & Shaw, 1973), no similar analysis is available for species in South America. In their monograph of the genus *Lesquerella,* Rollins and Shaw (1973: 1) stated that "the entire genus includes about a dozen species which occur in South America from southern Bolivia southward, but we have not studied these sufficiently to include them in the present treatment." Rollins did, in the early 1960s, begin looking at the genus in South America. We know this because his widow was kind enough to make his handwritten notes available to us. It is clear from reading these that at that time few specimens were available for study. We judge that sufficient materials are now available and that a preliminary assessment can be made of the genus in South America. While it would not surprise us if intensive field and laboratory work were to uncover as many as a dozen species, we here recognize five.

HISTORY OF THE SOUTH AMERICAN TAXA

The first South American collection assigned to what is now known as *Physaria* was based on material collected by J. Gillies from Santiago of Mendoza (Argentina) and determined by Barnéoud (1846) as the North American (Canada, Alaska) and northern Russian *Vesicaria arctica* Hooker. Philippi (1864) recognized that same collection as the new species *V. mendocina.* A year later, Eichler (1865) described *V. montevidensis* Eichler based on material collected by Sello from Montevideo (Uruguay). These two species were transferred to *Lesquerella* by Kurtz (1893) and Watson (1888), respectively. Muschler (1908) described two species of *Alyssum, A. boliviense* Muschler and *A. urbanianum* Muschler, which were reduced by Payson (1921) to synonymy of *L. mendocina* (Philippi) Kurtz. In addition to *L. mendocina,* Payson recognized *L. montevidensis* (Eichler) S. Watson and the Venezuelan *L. frigida* (Turczaninow) Payson, though he did not examine any material of these two species. Furthermore, the material he cited under *L. mendocina* does not belong to this species. Rollins (in Rollins & Shaw, 1973) was correct in excluding *L. frigida* from *Lesquerella* and placing it

in *Draba*, but the new name he proposed, *D. obscura* Rollins, was a later homonym, and the correct name of the species is *D. farsetioides* Linden & Planchon. Schulz (1934) described a new variety, *L. mendocina* var. *microcarpa* O. E. Schulz, and later (Schulz, 1936) treated both *A. boliviense* and *A. urbanianum* as synonyms of this variety. Subsequent accounts of *Lesquerella* from South America (e.g., Boelcke, 1967; Boelcke & Romanczuk, 1984) recognized only *L. mendocina* and overlooked the fruit diversity and habit that clearly divide the complex into five well-defined species (see Figs. 1–3).

The present account is provincial and is based primarily on material deposited in major herbaria. Fieldwork is needed to collect material for cytological and molecular studies and to fully understand the range of variation of each species. Although Manton (1932) reported $2n$ = ca. 50 for *Physaria* (as *Lesquerella*) *mendocina*, she did not leave voucher specimens that would enable the verification of the true identity of the species. Furthermore, this chromosome number clearly reflects a polyploidy level much higher than those compiled by Rollins and Shaw (1973) for the North American taxa (except the boreal *P. arctica* (Wormskjöld ex Hornemann) O'Kane & Al-Shehbaz with $2n$ = 60).

Morphological data indicate that the five South American species, which are limited to Argentina and immediately adjacent Bolivia and Uruguay, are basically indistinguishable in trichome type and density, shape of basal and cauline leaves, flower size and color, fruit indumentum, number of ovules/seeds per ovary/fruit, seed shape and size, and cotyledonary position. Petals in these species often fade, especially on drying, to pink or purple, a condition rarely seen in the North American species. These remarkable similarities support the hypothesis that the five species probably had a common origin from a North American ancestor and that it is likely that their migration into South America was a single event. Preliminary molecular studies by O'Kane (in progress) seem to support such an origin.

KEY TO THE SOUTH AMERICAN SPECIES OF *PHYSARIA*

1a. Style 0.7–1.5 mm long; stigma broadly capitate, considerably wider than style; fruit wider than long, subinflated . . . . . 3. *P. crassistigma*
1b. Style (2.5–)3–6(–8) mm long; stigma capitate, slightly wider than style; fruit as long as or longer than wide, not inflated.
  2a. Fruits terete.
    3a. Stems erect to ascending, often arising from the center of rosette; basal leaves dentate or repand-dentate; cauline leaves (7 to)9 to 17(to 25), ± spirally arranged; fruiting pedicels sigmoid or rarely straight . . . . . 1. *P. mendocina*
    3b. Stems procumbent to decumbent, arising laterally from the rosette; basal leaves entire; cauline leaves 3 to 11(to 16), secund; fruiting pedicels straight or inwardly curved but very rarely sigmoid . . . . . 2. *P. lateralis*
  2b. Fruits angustiseptate.
    4a. Stems (5- to) 7- to 18(to 28)-leaved, 3–13(–15) cm long; racemes (4)5- to 9(to 13)-flowered; petals 8–10(–13) × 3.5–5.5(–7) mm; fruits (6.5–)7–9(–10) × (4–)5–7 mm; fruiting pedicels sigmoid . . . . . 4. *P. urbaniana*
    4b. Stems leafless or 1- to 3(or 4)-leaved, to 1.3 cm long; racemes 1- to 3(or 4)-flowered; petals 4–5(–6) × ca. 2 mm; small fruits 4–5(–8) × 3–4(–5) mm; fruiting pedicels not sigmoid . . . . . 5. *P. pygmaea*

Physaria (Nuttall) A. Gray, Gen. Fl. Amer. Bor.-Orient. 1: 162. 1848 [1849]. TYPE: *Physaria didymocarpa* (W. J. Hooker) A. Gray (*Vesicaria didymocarpa* W. J. Hooker).

1. Physaria mendocina (Philippi) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Vesicaria mendocina* Philippi, Linnaea 33: 12. 1864. *Alyssum mendocinum* (Philippi) Kuntze, Revis. Gen. Pl. 2: 931. 1892. *Lesquerella mendocina* (Philippi) Kurtz, Revista Mus. La Plata 5: 286. 1893. TYPE: Argentina. Mendoza: "ad radicem Andium," *Wenceslav Diaz s.n.* (holotype, SGO).

Vesicaria montevidensis Eichler, in Martius, Fl. Brasil. 13(1) 302. 1865. *Lesquerella montevidensis* (Eichler) S. Watson, Proc. Amer. Acad. Arts 23: 251. 1888. TYPE: Uruguay. Near Montevideo, *Sello s.n.* (holotype, B).

Perennial herbs, sparsely to densely silvery pubescent throughout with stellate trichomes; caudex often slender, sometimes much elongated and rhizome-like, rarely thick and woody, simple or branched, sometimes with leaf remnants of previous years, branches terminated by leaf clusters; stems few or rarely many, erect or ascending, often arising from middle of rosette, (6–)10–45(–60) cm long. Basal leaves with petioles (1–)1.5–4(–5) cm long; leaf blade spatulate to oblanceolate, rarely linear-oblanceolate, (1–)2.5–7(–8) cm × 3–12(–15) mm, base attenuate to cuneate, margin dentate to repand-denticulate, rarely entire, apex obtuse to subacute; cauline leaves (7 to)9 to 17(to 25), ± spirally arranged, spatulate to narrowly oblanceolate, subsessile or short petiolate, base cuneate to attenuate, margin dentate or entire, apex obtuse or acute. Ra-

ceme 16- to 30-flowered, often elongated considerably in fruit; fruiting pedicels sigmoid or rarely straight, divaricate or rarely ascending or slightly reflexed, densely pubescent, slender, (5–)8–17(–25) mm long. Sepals narrowly oblong, non-saccate at base, silvery pubescent, 4.5–7.5 × 1.5–2 mm, caducous; petals pale to bright yellow, drying pink or purplish, obovate, 8–12 × 4.5–6.5 mm, apex rounded; filaments 5–8 mm long; anthers oblong, 1–1.5 mm long. Fruit globose, globose-ellipsoid, or ovoid, rarely obovoid, 4.5–6.5(–8) × 3.5–5 mm, terete, sparsely pubescent, sessile or on a stipe to 0.5 mm long, base obtuse or subacute, apex obtuse; ovules/seeds 4 to 8 per locule; style slender, (2.5–)3–6(–8) mm long, glabrous or sparsely pubescent basally; stigma only slightly wider than style; seeds compressed, ovate to ovate-orbicular, wingless, 2–2.7 × 1.5–2 mm; cotyledons accumbent.

Phenology, distribution, and elevation. Flowering late September through December, fruiting mid October to early February in Argentina (Buenos Aires, Córdoba, La Pampa, Mendoza, Neuquén, Río Negro, and San Luís) and Uruguay at 250–1600 m.

Physaria mendocina is the most widespread and variable of all of the South American species of *Physaria.* Although the caudex is few-branched in most specimens examined, in *Rentzell 1109* (F, SI), the caudex is much elongated and rhizome-like. The basal leaves are coarsely dentate, though in *Cabrera s.n.* (SI) subentire leaves are found in the same population that otherwise has dentate leaves, and in very rare cases, *Ameghino s.n.* (BA), the basal leaves are entire, linear, and to 1 mm wide. The fruiting pedicels in most samples examined are slightly sigmoid, but in *Gomez et al. 2791* (BAA, CTES) they are strongly sigmoid and somewhat reflexed, whereas in *Cano 2698* (BAA) they are straight and ascending and in *Barkley 20Mz207* (F, W) the lowermost are up to 2.5 cm long. Fruit shape can also vary in the same population, and in *Cámara et al. 15* (BAA) the fruits vary from typically globose to obovoid with a subacute base. One collection, *Comber 856* (E, K), has the largest flowers (petals ca. 12 × 6 mm and style to 7 mm long) in the species. The specimen at K was annotated by Reed C. Rollins as the holotype of "Lesquerella comberi Rollins," a name that was never published. The variation in all parts of the plant, however, does not form any coherent patterns that would allow the recognition of infraspecific taxa.

Physaria mendocina occupies the lowermost altitudes (250–1600 m vs. (1000–)1700–4400 m) among the Argentinian species of the genus. Its probable nearest relative, *P. lateralis,* occupies somewhat higher elevations, though their distributional ranges overlap in several areas. In one case of such sympatry, *Hunziker 7553* (GH), no intermediates between the two species have been found.

The illustration of *Physaria mendocina* in Boelcke and Romanczuk (1984: 455) accurately shows the overall habit, flowers, and fruit of the species, but the trichomes were erroneously drawn because they show all rays rigid and unbranched, when in fact they are slender and branched, as in all of the South American species of *Physaria.*

Representative specimens examined. ARGENTINA. **Buenos Aires:** Partido de Tornquist, Sierra de la Ventana, Cerro de la Ventana, *Cabrera s.n.* (GH, SI), *Gómez et al. 2791* (BAA, CTES); Ptdo. Cnel. Dorrego, Monte Hermosa, *Eskuche 647* (BAA); Monte Hermoso, Part. Leonardo Rosals, *Verihoni 2562* (BAA); Claromecó, Part. Tres Arroyos, *Verihoni 2553* (BAA); Choique, *Parodi 13756* (BAA); Pique, Sierra de la Ventana, *Rentzell 1109* (F, SI). **Córdoba:** Malaguezo, *Hunziker 6731* (GH); Villa Brochero, *Castellanos 10519* (BA); Sierra Chica, Mina del Tauro, *Castellanos 24/463* (BA); Dept. Talumba, San Pedro Norte, *Albelló 12022* (BAA); Cuesta de San Iguaçu, *Kurtz 2859* (R); Cerritos de Malgueño, *A. T. Hunziker 7553* (GH); San Estaban, *Nicore 1622* (BAA). **La Pampa:** Pque. Nac. Lihuel Calel, *Cámara et al. 15* (BAA, MO); Dpto. Leventué, rutal 148, Cerro, *Cano 2698* (BAA). **Mendoza:** 20 km al suroeste de Campo de los Andes, *Barkley 20Mz207* (F, W); Lujan, Cerro Cacheuta, *Leal 12747* (P); Rio Diamente, near San Rafail, *Böcher et al. 677* (BAA, MO). **Neuquén:** Vega Lolog, *Comber 856* (E, K). **Río Negro:** Viedma, médanos del Faro, *Castellanos 28/1134* (BA); Rio Negro inférieur, *Février 3793* (BA); Dpto. San Antonio, Sierra Gran de Yacimiento ferrigero Sur, proc a Loma Blanca, *Piccinini & Garcia 1591* (BAA); Paso Flores, *Schajovskoy 308* (M). **San Luís:** Sierra Varela, *Castellanos 25/2836* (BA); Dpto. La Capital, Ruta provincial no. 3 ingreso a la Cantera San José, *Del Vitto et al. 6315* (CTES); Cropuche, *Varelov 661* (S). URUGUAY. **Paysandu:** Chapicuy-Orillas del Río Uruguay, mesita de Atiga, n.d., *Rossengurtt 4193* (BAA).

2. Physaria lateralis O'Kane & Al-Shehbaz, sp. nov. TYPE: Argentina. San Luís: Dpto. Pringles, entre El Totoral y La Arenilla, 7 Jan. 1989, *Luis A. Del Vitto, Elisa Petenatti & M. Pagliarone 2970* (holotype, CTES; isotype, UNSL). Figure 1.

Lesquerella mendocina (Philippi) Kurtz var. *microcarpa* O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 12: 41. 1934. TYPE: Argentina. San Luís: Sierra de San Luís, Peñon Colorado, 18 Dec. 1929, *A. Castellanos 29/333* (holotype, B; isotype, BA).

Herba perennis, (3–)4–24 cm longa, caudicibus tenuibus vel crassis, simplicibus vel ramosis; caules procumbentes vel decumbentes. Folia basalia integra; folia caulina 3–11(–16), secunda. Racemi (5–)7–20(–27)-flori; pedicelli fructiferi recti vel curvati, 5–10 mm longi. Petala

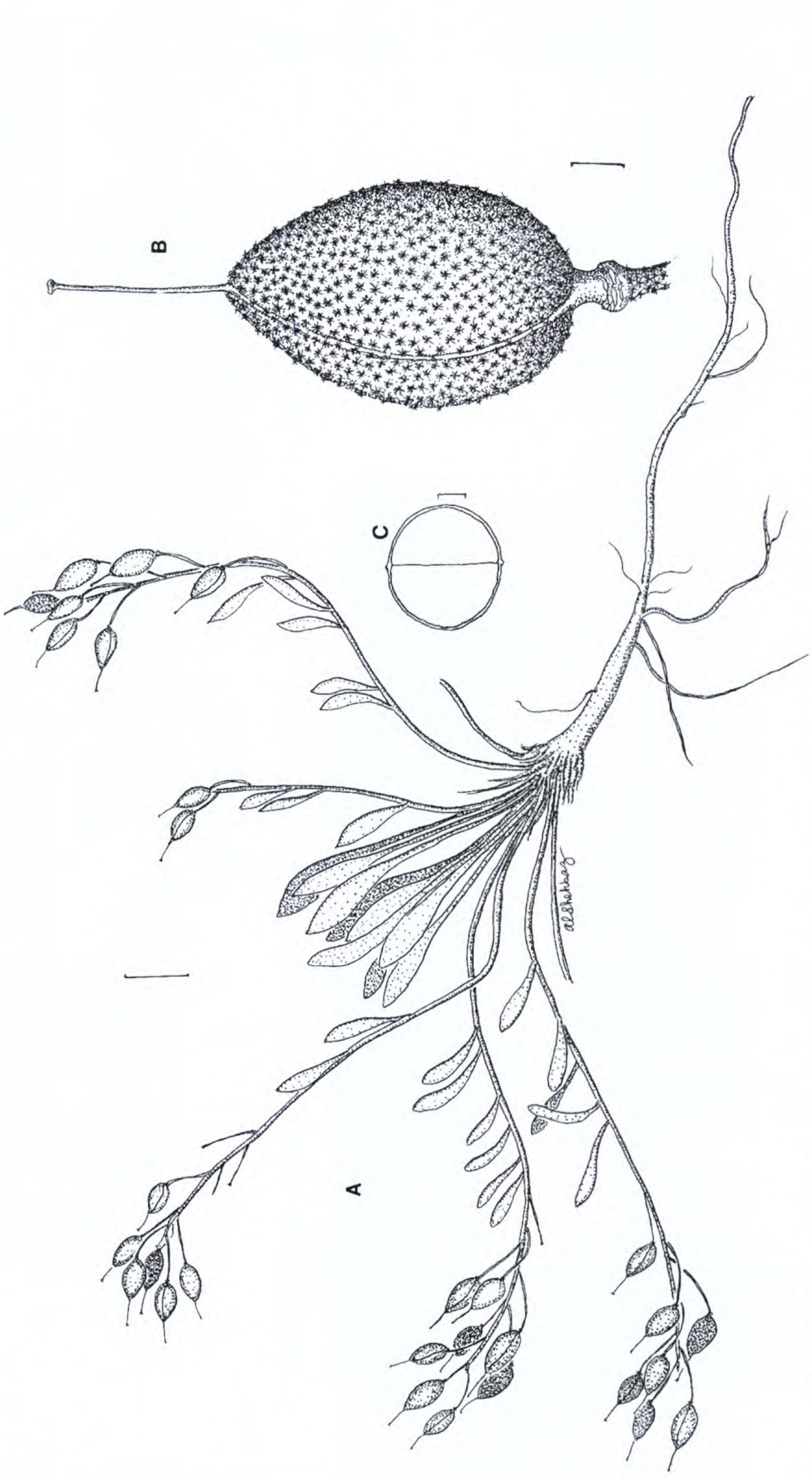

Figure 1. *Physaria lateralis* O'Kane & Al-Shehbaz. —A. Plant. —B. Fruit. —C. Diagrammatic cross section of fruit. Scale: A = 1 cm; B, C = 1 mm. Drawn by Al-Shehbaz from the holotype, *Del Vitto et al. 2970* (CTES).

obovata, 7–11 × 3–5 mm. Fructus globosi, ovoidei, vel subellipsoidei, teretes, (3.5–)4–7 × 3–5(–6) mm, basi et apice obtusi; stylus tenuis, (2.5–)3–5(–6) mm longus; stigma tenue.

Perennial herbs, sparsely to densely silvery pubescent throughout with stellate trichomes; caudex slender or stout, woody, simple or rarely few-branched, sometimes with leaf remnants of previous years; stems few to several, procumbent to decumbent, arising from outside of rosette, (3–)4–24 cm long. Basal leaves with petioles 0.5–1.5(–3) cm long; leaf blade oblanceolate, rarely linear-oblanceolate or spatulate, 1.5–3.5 cm × 3–7 mm, base attenuate to cuneate, margin entire, apex acute to subobtuse; cauline leaves 3 to 11(to 16), ± secund, linear to narrowly oblanceolate, subsessile, base attenuate, margin entire, apex subacute. Raceme (5-to)7- to 20(to 27)-flowered, elongated in fruit; fruiting pedicels straight or curved inward, very rarely sigmoid, divaricate or ascending, densely pubescent, slender, 5–10 mm long. Sepals narrowly oblong, non-saccate at base, silvery pubescent, 4–6 × 1.5–2 mm, caducous; petals pale to bright yellow, drying pink or purplish, obovate, 7–11 × 3–5 mm, apex rounded; filaments 4–5.5 mm long; anthers oblong, 1–1.5 mm long. Fruit globose, ovoid to subellipsoid, (3.5–)4–7 × 3–5(–6) mm, terete, sparsely pubescent, sessile or on a stipe to 0.5 mm long, base and apex obtuse; ovules/seeds 2 to 5 per locule; style slender, (2.5–)3–5(–6) mm long, glabrous or sparsely pubescent basally; stigma only slightly wider than style; seeds compressed, ovate to ovate-orbicular, wingless, 1.8–2.5 × 1.2–2 mm; cotyledons accumbent.

Phenology, distribution, and elevation. Flowering late September through December, fruiting mid October to early February in Argentina (Córdoba, Mendoza, Neuquén, and San Luís) at (1000–)1700–2950 m.

Physaria lateralis, which derives its name from the lateral origin of branches in relation to the basal rosette, most closely resembles *P. mendocina,* especially in flower and fruit morphology, but it differs by having procumbent to decumbent stems arising laterally from the rosette, entire basal leaves, secund, 3 to 11(to 16) cauline leaves, straight or inwardly curved but rarely sigmoid fruiting pedicels, and ovaries/fruits generally with 2 to 4(or 5) ovules/seeds per locule. By contrast, *P. mendocina* has erect to ascending stems arising from the center of the rosette, at least some dentate or repand-dentate basal leaves, spirally arranged, (7 to)9 to 17(to 25) cauline leaves, sigmoid or rarely straight fruiting pedicels, and ovaries/fruits generally with (4 or)5 to 8 ovules/seeds per locule.

The fruits of *Physaria lateralis* exhibit the same pattern of variation seen in *P. mendocina,* and the type collection of *P. lateralis* has fruits ranging in shape from globose to subellipsoid. Contrary to *P. mendocina,* which has primarily sigmoid fruiting pedicels, those of *P. lateralis* are straight or curved inward, and only rarely are they sigmoid, as in *Sleumer 435* (B).

Physaria lateralis is indistinguishable from *Lesquerella mendocina* var. *microcarpa* in every aspect. Since that varietal name has priority only at its rank, we had the choice to either raise it to the specific rank or describe the taxon as a new species based on a different type. We prefer the latter action and base the new species on more complete material, instead of proposing a new combination based on the fragmentary type collection of variety *microcarpa.*

Paratypes. ARGENTINA. **Córdoba:** Nono, entre Mina Clavero y Villa Dolores, *A. T. Hunziker 7849* (BAA); Cerritos de Malgueño, *A. T. Hunziker 7553* (GH); Taninga, 15 km W camino Los Tuneles, *O. Boelcke 7725* (BAA), *O. Boelcke 7726* (BAA); Camino M Clavero–La Plata (Pampa de Achala), *O. Boelcke 7783* (BAA), *Tirel 406* (P); Pampa de Pocho, *Ragonese & Piccinini 9734* (BAA); Los Coquitos, Dpto. Ischilín, *T. M. Pedersen 9926* (BAA, K). **Mendoza:** Queb. Chacay, Cord. Del Tigre, *D. O. King 346* (BM); Tupungato, *H. Sleumer 435* (LIL), *F. O. Roig 160* (BAA), *R. Leal 3643* (LIL); halfway betw. Fort San Rafael & El Purito del Monte, *J. Gillies s.n.* (GH); Dpto. San Rafael, Sa. del Nevado, laderas entre La Cienaguita y el Zanjón del Plateado, *O. Boelcke et al. 15973* (BAA); pampa entre arroyo Agua del Guacho y el zanjón del Plateado al S-SE del los Cos. Morados, *O. Boelcke et al. 15611* (BAA), *O. Boelcke et al. 15709* (BAA), *O. Boelcke et al. 15738* (BAA); laderas alrededor de la Cienaguita, *O. Boelcke et al. 15679* (BAA); Tunuyán, Puesto Gendarmería Alférez Portinari, Ao. Cascada del la Vieja, *O. Boelcke et al. MC272* (BAA); Tupungate, Río La Carrera, *O. Paci & O. Melis 96* (GH); Potrerillos, estancia "El Salto," *Ragonese 12589* (GH); betw. Rt. 40 & Lag. Diamante, *T. W. Böcher et al. 2049* (BAA); Atuel Valley near the outlet of Arroyo Blanco, *T. W. Böcher et al. 1044* (BAA). **Neuquén:** Dpto. Catán-Lil, Rt. 40 a 5 km S de Ao. China Muerta, *J. Vallerini & J. Brun 654* (BAA). **San Luís:** Sierras, del San Luis Peñón Colorado, *A. Castellanos 29/333* (B, BA); Pancanta, *A. Castellanos 25/705* (BA); Comechingones, *A. Castellanos 25/2576* (BA); Altp Rodeo X Piscada del Gigante, *A. Castellanos 26/2112* (BA); Dept. Pringles, Valle de Pan canta, Hostería "Las Verbenas," *J. G. Hawkes et al. 3176* (BAA); Dpto. Pringles, ruta prov. 9, entre Los Tapiales y La Arenilla, *R. Kiesling et al. 4724* (SI); 5 km NE of Carolina, *R. R. Brooks et al. MS121* (MO).

3. **Physaria crassistigma** O'Kane & Al-Shehbaz, sp. nov. TYPE: Argentina. Mendoza: Dpto. Las Heras, Estancia San Isidro, Pampa de Los Ñangos, 2450 m, 14 Jan. 1964, *Ruiz Leal 23145* (holotype, BAA). Figure 2.

Figure 2. *Physaria crassistigma* O'Kane & Al-Shehbaz. —A. Plant. —B. Basal leaf. —C. Fruit and fruiting pedicel. —D. Diagrammatic cross section of fruit. Scale: A = 1 cm; B = 5 mm; C, D = 1 mm. Drawn by Al-Shehbaz from the holotype, *Leal 23145* (BAA).

Herba perennis, 2–18(–23) cm longa, caudicibus crassis, simplicibus; caules procumbentes vel decumbentes. Folia basalia dentata vel dentato-repanda; folia caulina (3–)5–13(–15), spiraliter vel subsecunda. Racemi 5–10(–18)-flori; pedicelli fructiferi sigmoidei, (5–)6–12(–17) mm longi. Petala obovata, 9–11 × 4–5 mm. Fructus subglobosi, subinflati, teretes, latiores quam longiores, 4.5–6 × 5–8 mm, basi subcordati vel obtusi, apice subemarginati vel subtruncati; stylus crassis, 0.7–1.5 mm longus; stigma crassum.

Perennial herbs, sparsely to densely silvery pubescent throughout with stellate trichomes; caudex often stout, woody, simple or rarely branched, often with leaf remnants of previous years; stems few or several, procumbent or decumbent, 2–18(–23) cm long. Basal leaves with petioles 0.7–2 cm long; leaf blade oblanceolate, rarely linear-oblanceolate, 1–2.7 cm × 2–6 mm, base attenuate to cuneate, margin dentate to repand-denticulate, apex obtuse to subacute; cauline leaves (3 to)5 to 13(to 15), spirally arranged or subsecund, linear to linear-oblanceolate, subsessile or short-petiolate, base cuneate to attenuate, margin repand or entire, apex obtuse or acute. Raceme 5- to 10(to 18)-flowered, elongated slightly in fruit; fruiting pedicels strongly sigmoid, divaricate or rarely ascending, densely pubescent, slender, (5–)6–12(–17) mm long. Sepals narrowly oblong, non-saccate at base, silvery pubescent, 5–7 × 1.5–2 mm, caducous; petals pale to bright yellow, drying pink or purple, obovate, 9–11 × 4–5 mm, apex rounded; filaments 4–5 mm long; anthers oblong, 1–1.5 mm long. Fruit subglobose, subinflated, wider than long, 4.5–6 × 5–8 mm, terete, sparsely pubescent, sessile or on a stipe to 0.5 mm long, base subcordate to obtuse, apex subemarginate to subtruncate; ovules/seeds 4 to 8 per locule; style stout, 0.7–1.5 mm long, glabrous; stigma broadly capitate, considerably wider than style, sometimes as wide as style length; seeds compressed, ovate to ovate-orbicular, wingless, 2–2.5 × 1.5–2 mm; cotyledons accumbent.

Phenology, distribution, and elevation. Flowering early November through December, fruiting late November to early January in Argentina (Mendoza) at 2200–2900 m.

The characteristically short (0.7–1.5 mm) style, broadly capitate stigma considerably wider than the style, and often apically and basally depressed fruits wider than long readily distinguish *Physaria crassistigma* from the other South American species of the genus. The species resembles *P. mendocina* in having dentate or dentate-repand basal leaves and nearly similar flower size and number of ovules per locule. The two species can easily be distinguished in flower by the examination of style and stigma: short styles and broad stigmas in *P. crassistigma*, and slender styles and narrow stigmas in *P. mendocina*.

Paratypes. ARGENTINA. **Mendoza:** Dpto. Lujan de Cuyo ± 500 m al w de Puesto Reinoso Cno a Vallecitos, Barranca al Rio Blanca, *D. Medan et al. 879* (BAA); Sierra del Plata, *D. O. King 119* (BM); Los Arenales, Villavicencio & San Rafael, Andes of Mendoza, *J. Gillies s.n.* (K); Aleli del Campo, between Los Liacayus & Los Arenales, *J. Gillies s.n.* (K); Los Cerros del Morro, del Portuzecelo, Prov. of San Luís and Los Arenales, San Rafael, Andes of Mendoza, *J. Gillies 16* (E); Vallecito, *H. L. Hauman 1318* (BA); Dpto. Las Heras, Villavicencio, *H. Sleumer 513* (B); Dpto. Las Heras (Estancia San Isidro), Agua de Los Pajaritos, *R. Leal 23131* (BAA); Dpto. Tunuyan (Camino al Paso del Postillo nieudocino), Cuesta de Los Afligidos, *R. Leal 1879* (BAA); Dpto. Las Heras, Paramillo de Uspallata, *R. Leal 18717* (BAA); above Villavicencio, *T. W. Böcher et al. 2141* (BAA).

4. **Physaria urbaniana** (Muschler) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Alyssum urbanianum* Muschler, Bot. Jahrb. Syst. 40: 274. 1908. TYPE: Bolivia. Tarija: Escayache near Tarija, 3600 m, 1 Feb. 1904, *K. Fiebrig 3034* (holotype, M; isotypes, BM, E, GH, K).

Alyssum boliviense Muschler, Bot. Jahrb. Syst. 40: 274. 1908. Syn. nov. TYPE: Bolivia. Puna Patanca, 3700 m, 8 Jan. 1904, *K. Fiebrig 2619* (holotype, M; isotypes, BM, E, GH, K).

Perennial herbs, densely silvery pubescent throughout with stellate trichomes; caudex thick, woody, simple or branched, often with leaf remnants of previous years, branches terminated by leaf clusters; stems few to many, procumbent or decumbent, 3–13(–15) cm long. Basal leaves subsessile or with petioles rarely to 1 cm long; leaf blade spatulate to narrowly oblanceolate, rarely broadly spatulate or obovate, 1–3(–5) cm × 2–3.5(–5) mm, base attenuate, margin entire, apex obtuse to subacute; cauline leaves (5 to)7 to 18(to 28), secund, spatulate to narrowly oblanceolate, base attenuate, margin entire, apex obtuse. Raceme (4- or)5- to 9(to 13)-flowered, subcorymbose or rarely elongated considerably in fruit; fruiting pedicels sigmoid or rarely straight, divaricate or rarely ascending, densely pubescent, slender, 5–13 mm long. Sepals narrowly oblong, non-saccate at base, silvery pubescent, 5–7.5 × 1.5–2 mm, caducous; petals pale to bright yellow, drying pink or purple, obovate, 8–10(–13) × 3.5–5.5(–7) mm, apex rounded; filaments 4.5–6 mm long; anthers oblong, 1–1.5 mm long. Fruit ellipsoid to ovoid, (6.5–)7–9(–10) × (4–)5–7 mm, angustiseptate, sparsely pubescent, sessile or minutely stipitate, base obtuse to subcordate, apex subacute; ovules/seeds (3 or)4 to 6 per locule; style slender, (2.5–)3–5(–6.5) mm long, glabrous or sparsely pubescent basally; stigma only

slightly wider than style; seeds compressed, ovate to ovate-orbicular, wingless, (1.5–)2–2.5 × (1–)1.5–2 mm; cotyledons accumbent.

Phenology, distribution, and elevation. Flowering mid November through January, fruiting December to late February (rarely early April) in Argentina (Catamarca, Jujuy, La Rioja, Mendoza, Salta, and Tucumán) and southern Bolivia at (2000–)2300–4000(–4400) m.

A critical examination of the type collections of *Alyssum boliviense* and *A. urbanianum* reveals that they represent a single species and were based on flowering and fruiting material, respectively. Muschler (1908) indicated that the two species differ in leaf shape and in having petiolate (*A. boliviense*) instead of sessile (*A. urbanianum*) leaves, but these differences show continuous variation within the species.

Two collections, *Venturi 6607* and *7413* (both at US), have thick and long styles (6–6.5 mm), and the labels state that the flowers are white. White flowers are rare in *Physaria*, and more fieldwork is needed to confirm the identity of these collections because they have immature fruits. It is quite possible that the material represents an undescribed taxon. In other plants of *P. urbaniana*, the style reaches a maximum length of 5 mm. In general, plants of this species have short stems, apparently growing primarily between rocks and in rock crevices, but in a few collections (e.g., *Araque & Barkley 19Ar159* (F) and *Jörgensen 1062* (A, GH, MO, US)) the plants are about 15 cm long. Broadly spatulate to obovate basal leaves are rather rare in the species and were observed thus far only in *Böcher et al. 1407* (BAA).

Specimens examined. ARGENTINA. **Catamarca:** Dpto. Pomán, en el camino desde Los Ciénegos al Alto de la Cruz, 22 km al SSE de Pomán, *Vervoorst 3449* (W); Acongria, *H. & O. Brücher s.n.* (S); Dpto. Belén, Faldeos al N del Portezuelo del Rio Blanco, arriba de Granadillas, *Sleumer & Vervoorst 2587* (BAA, LIL, US); Comun Cerro negro, *Jörgensen 1062* (A, GH, MO, US); Dept. Santa Maria, Sierra de Onconquija, *Venturi 6607* (US). **Jujuy:** Esquinas Blancas, *Shapiro s.n.* (GH); Dpto. Humahuaca, Mina Aquilar, entre Tres Cruces y Molino, *Ruthsatz 9753* (BAA); Dpto. Cochinoca, camino de Casas Grandes a la Mina A. Espinosa del Diablo, *Ancibor & Mujica 15* (BAA, GH); Dpto. Tumbaya, Abra Portillo, Rt. 52, *Nicora et al. 8821* (SI); Dept. Zilcara, Zilcara, *Venturi 7413* (US). **La Rioja:** Sierra de Famatina, Pampa de Chilitauca, *Krapovickas & Hunziker 5224* (BAA); Quebrada de Potrerillos, *Krapovickas & Hunziker 5410* (BAA). **Mendoza:** Tres Lagunas, frente a la vertiente occidental de la Cuchilla de la Tristeza, *Castellanos 47495* (US); Atuel Valley, 30 km from El Sosneado, *Böcher et al. 1407* (BAA). **Salta:** Dpto. Iruya, ca del cruce del camino a Bovazuli, *Bliarpin & Novara 23183* (MO); Dept. Cafayate, Sierra de los Quilmes, 1 Jan. 1943, *Castellanos s.n.* (GH); Dpto. San Carlos, Cerro de Cachi, *Venturi 6744* (US). **Tucumán:** Dep. Tafí, Infiernillo, Quebrada Honda, *Petersen & Hjerting 799* (BAA); Infiernillo, *Krapovickas & Cristóbal 20518* (CTES), *Hjerting et al. 9405* (BAA); 25 km N of Tufí del Valle on road to Amaicha del Valle, *Hammel 5933* (MO); Tafí del Valle, *Calderá et al. 67* (BAA), *Araque & Barkley 19Ar159* (F); Cerro pelado, *Sleumer 157* (B); Sa. Aconquija, El Infiernillo, *Hunziker 7247* (GH); Co. El Negrito (ladera S.E.), *Giusti et al. 3868* (BAA); El Infiernillo-Alrededores del mástil, *Figuiroa et al. 254* (LIL); Angostura, *Solbrig 4200* (GH); Lara, *Rodriguez 296* (BA, GH); Dept. Chicligaasta, Estancia Santa Rosa, *Venturi 7608* (US); campo de la flora San José, *Schreiter 7016* (A).

5. Physaria pygmaea O'Kane & Al-Shehbaz, sp. nov. TYPE: Argentina. Tucumán: Dpto. Tafí, cumbres Calchaquíes, Huaca Huasi, 4300 m, 26°40′S, 65°44′W, 13 Mar. 1984, *E. Gómez-Sosa & M. Múlgura 189* (holotype, MO; isotypes, ISTC, SI). Figure 3.

Herba perennis minuta, 0.5–1(–1.3) cm longa, caudicibus crassis, simplicibus; caules procumbentes vel decumbentes. Folia basalia integra; folia caulina nulla vel 1–3(–4). Racemi 1–3(–4)-flori; pedicelli fructiferi recti vel curvati, 3–6 mm longi. Petala obovata, 4–5(–6) × ca. 2 mm. Fructus ovoidei, compressi, angustiseptati, 4–5(–8) × 3–4(–5) mm, basi et apice obtusi; stylus tenuis, 2.5–3.5 mm longus; stigma tenue.

Perennial, tiny herbs, silvery pubescent throughout with stellate trichomes; caudex thick, woody, simple or rarely few-branched, often with leaf remnants of previous years; stems 1 or few, procumbent, 0.5–1(–1.3) cm long. Basal leaves sessile; leaf blade linear to narrowly oblanceolate, 0.5–1(–1.3) cm × 1–2 mm, base attenuate, margin entire, apex obtuse to subacute; cauline leaves absent or 1 or 3(or 4), secund, linear- to narrowly oblanceolate, base attenuate, margin entire, apex obtuse. Raceme 1- or 3(or 4)-flowered, subcorymbose not elongated in fruit; fruiting pedicels straight or slightly curved, not sigmoid, divaricate, densely pubescent, slender, 3–6 mm long. Sepals narrowly oblong, non-saccate at base, silvery pubescent, 3–4 × ca. 1 mm, caducous; petals pale to bright yellow, obovate, 4–5(–6) × ca. 2 mm, apex rounded; filaments 3–4 mm long; anthers oblong, ca. 1 mm long. Fruit ovoid, 4–5(–8) × 3–4(–5) mm, angustiseptate, sparsely pubescent, sessile, base and apex obtuse; ovules/seeds 4 to 6 per locule; style slender, 2.5–3.5 mm long, glabrous; stigma only slightly wider than style; seeds compressed, orbicular to ovate-orbicular, wingless, 1.5–2.5 × 1–1.5 mm; cotyledons accumbent.

Phenology, distribution, and elevation. Flowering mid December through January, fruiting January to early March in Argentina (Tucumán, Jujuy, and La Rioja) at 2500–4300 m.

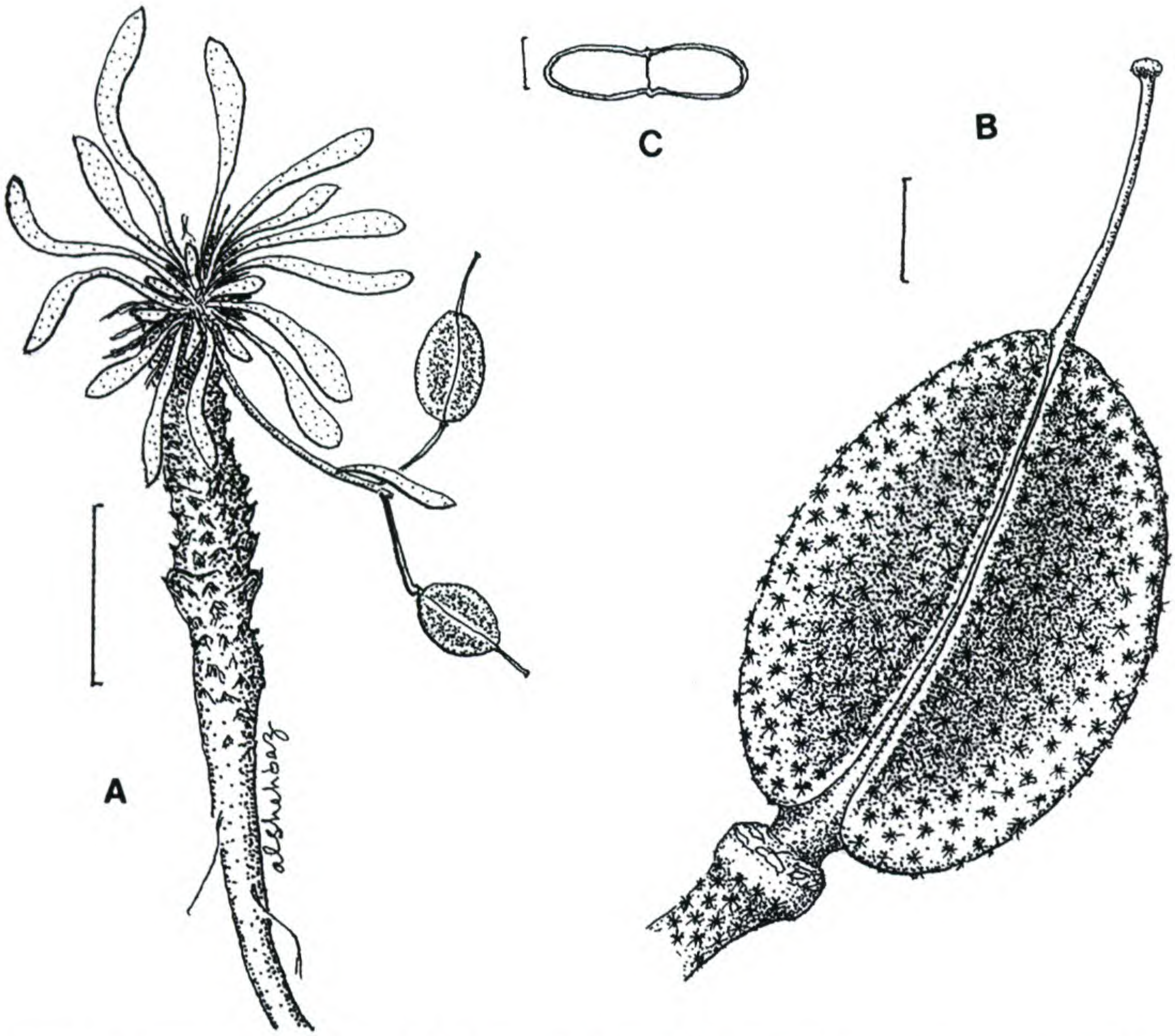

Figure 3. *Physaria pygmaea* O'Kane & Al-Shehbaz. —A. Plant. —B. Fruit. —C. Diagrammatic cross section of fruit. Scale: A = 1 cm; B, C = 1 mm. Drawn by Al-Shehbaz from the holotype, *Gómez-Sosa & Múlgura 189* (MO).

Physaria pygmaea appears to be most closely related to *P. urbaniana*, which it resembles in having angustiseptate fruits and entire leaves. It is a much smaller plant with short, leafless or 1- to 3(or 4)-leaved fruiting stems rarely reaching 1.3 cm in length, 1- to 3(or 4)-flowered racemes, smaller petals 4–5(–6) × ca. 2 mm, non-sigmoid fruiting pedicels, and small fruits 4–5(–8) × 3–4(–5) mm. By contrast, *P. urbaniana* has (5- to)7- to 18(to 28)-leaved stems 3–13(–15) cm long, (4- or)5- or 9(to 13)-flowered racemes, larger petals 8–10(–13) × 3.5–5.5(–7) mm, sigmoid fruiting pedicels, and larger fruits (6.5–)7–9(–10) × (4–)5–7 mm.

Paratypes. ARGENTINA. **Jujuy:** Dpto. Humahuaca, Mina Aquilar, Espinozo del Diablo, *B. Ruthsatz 278* (BAA); entre Tres Cruces y Molino, *B. Ruthsatz 9752* (BAA); Dpto. Cochinoca, Espinazo del Diablo, *E. Ancibor & B. Ruthsatz 2046* (BAA); Tilcara, arriba de San Gregorio, *H. Sleumer 3134* (BAA). **La Rioja:** La Hoyada, Sierra Famatina arriba de Vallecito, *J. Jimenez s.n.* (GH).

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A New Species of *Pariana* (Poaceae: Bambusoideae: Olyreae) Endemic to the Atlantic Moist Forest in the State of Bahia, Brazil

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ABSTRACT. A new species of *Pariana* from the Atlantic forest of the Brazilian state of Bahia is described. *Pariana carvalhoi* is an herbaceous bamboo (Poaceae: Bambusoideae: Olyreae) that resembles *P. lanceolata* but differs from it by the very short to absent fimbriae at the leaf sheath apex. Both species are endemic to Bahia, Brazil. The new species is only known from the locality of Una, in southern Bahia. It grows in remnants of humid forest and should be considered as critically endangered.

Key words: Bahia, Bambusoideae, Brazil, Olyreae, *Pariana*, Poaceae.

Pariana Aublet includes about 30 species distributed in the Amazon Basin from Costa Rica and Trinidad, to Bolivia and Brazil (Judziewicz et al., 1999). It has been included in its own tribe Parianeae by several authors (Calderón & Soderstrom, 1980; Clayton & Renvoize, 1986; Hollowell, 1994), but presently it is considered a genus of the tribe Olyreae (Clark et al., 1995; Hollowell, 1987, 1997; Zhang & Clark, 2000). *Pariana*, together with *Eremitis* Döll, is classified in the subtribe Parianinae (Hollowell, 1987, 1997), which is characterized by the presence of fimbriae at the apex of the leaf sheaths, termed oral setae (Calderón & Soderstrom, 1980; Hollowell, 1987, 1997), and by the spiciform inflorescence with each whorl presenting one female central spikelet surrounded by five male spikelets. Each of these gynecandrous whorls corresponds to a diaspore of the species, shattering as intact spikelet whorls. According to Soderstrom and Calderón (1971, 1974), the showy inflorescences of *Pariana* species attract insects especially by the easily visible anthers, and these bamboo grasses are probably entomophilous. The pollen grains of some *Pariana* species differ from the basic pattern found in grasses (anemophily) by showing an areolate exine, sometimes vestigial columellae, and no distinct annulus (Salgado-Labouriau & Rinaldi, 1990; Salgado-Labouriau et al., 1993); this would offer more friction in wind transport than the smooth surface of other grass pollen grains. The absence of an annulus in *Pariana* pollen was confirmed, and the developmental detail of its microspore has been further investigated by Skvarla et al. (2003).

According to Clark (1990) the state of Bahia represents a significant center of diversity for Neotropical bamboos, with many new species being described from this area. The two species of *Pariana* found in Bahia, *P. lanceolata* Trinius (cf. Renvoize, 1984) and the new species described here, differ from other species of the genus by the barbate style, the smaller number of pale stamens (2 vs. 6 to 36 or more, with pale to bright yellow anthers, within *Pariana*), and the much longer pedicels of the male spikelets. Due to this reduced number of stamens, the inflorescences of the new and Bahian species are less conspicuous than those of other *Pariana* species.

The new species epithet, *Pariana carvalhoi*, honors the outstanding botanist André Maurício de Carvalho (1951–2002), who for many years was the curator of the herbarium at CEPLAC (Cocoa Research Center in Ilhéus, Bahia) and was a great

Figure 1. A–C, *Pariana lanceolata* Trinius. —A. Habit. —B. Inflorescence whorl of male and female spikelets, the solitary female spikelet cryptic. —C. Apex of leaf sheath with fimbriae evident and numerous. D–N, *Pariana carvalhoi* R. P. Oliveira & H. M. Longhi-Wagner. —D. Habit. —E. Apex of leaf sheath with fimbriae absent or vestigial. —F. Inflorescence whorl. —G. Central female spikelet. —H. Articulate inflorescence rachis. —I. Female anthecium, ventral aspect. —J. Female anthecium, dorsal aspect. —K. Male spikelet with adnate laminar pedicel, dorsal aspect. —L. Male anthecium, ventral aspect. —M. Male anthecium, dorsal aspect. —N. Caryopsis. A–C drawn from *W. W. Thomas et al. 9399* (CEPEC); D–N drawn from the holotype, *A. M. Carvalho et al. 4382* (CEPEC). Illustration prepared by Ivan Farias de Castro and Reyjane Patricia de Oliveira.

defender and advocate for the preservation of the Atlantic forest in eastern Brazil.

KEY TO THE SPECIES OF *PARIANA* IN BAHIA, BRAZIL

1. Leaf sheaths with numerous fimbriae at the apex, 0.7–20 mm long; leaf blades lanceolate (7.5–)11–16(–21.4) × 0.7–1.7(–2.5) cm . . . *Pariana lanceolata*
1′. Leaf sheaths without fimbriae at the apex, rarely with 1 to 3 vestigial fimbriae, less than 1 mm long; leaf blades ovate-lanceolate, (6–)11.5–20 × 2.1–3.4 cm . . . . . *Pariana carvalhoi*

Pariana carvalhoi R. P. Oliveira & H. M. Longhi-Wagner, sp. nov. TYPE. Brazil. Bahia: Una, along road São José/Una, 10 Feb. 1994, *A. M. Carvalho, L. G. Clark, T. S. dos Santos, W. W. Thomas & S. Sant'Ana 4382* (holotype, CEPEC; isotype, ISC). Figure 1.

Herba perennis cespitosa; vaginae glabrae raro fimbriatae; folia ovato-lanceolata. Spiculae masculae pedicellis longis, pilosis; stamina 2.

Plants with monomorphic stems 40–75 cm tall, 2–4 mm diam., glabrous or pilose, bearing 3 to 6 leaves; nodes glabrous, with a small conspicuous scar beneath. Leaf sheaths glabrous or rarely ciliate at the margins; apex usually without oral fimbriae, rarely with 1 to 3 vestigial fimbriae, less than 1 mm long; leaf blades (6–)11.5–20 × 2.1–3.4 cm, ovate-lanceolate, base symmetrical, attenuate, apex symmetrical, acuminate, both blade surfaces adaxially and abaxially glabrous or ciliate along the adaxial midrib, blade margins scaberulous; pseudopetioles 1–1.6 mm long; ligules 0.3–0.5 mm long. Inflorescence 6.5–8 × 0.5–0.8 cm, terminal and spiciform, with 6 to 8 spikelet whorls 12.5–14 × 0.5–0.8 mm; rachis 9–9.5 mm long, scaberulous. Female spikelets 10–11.2 × 2.6–3 mm, oblong, glabrous; glumes 9–10 mm long, both acuminate or shortly caudate, totally glabrous or with short trichomes at the apex; anthecium 9.5–11 × 2–3 mm, oblong-lanceolate, yellowish or dark brown. Male spikelets 2–2.5 × 1.2–1.5 mm, oblong-ovate, brown; pedicels 7–8.2 mm long, laminar, usually pilose; glumes 2–3 mm long, oblong-triangular, pilose; lemmas puberulent, 3-nerved; stamens 2. Caryopsis glabrous, cryptic but free within the persistent anthecium, apex with erect stylar remnants, hilum linear.

Pariana carvalhoi differs from *P. lanceolata* especially by its wider leaf blades that are ovate-lanceolate (vs. lanceolate in *P. lanceolata*), and by the absence of fimbriae at the apex of the leaf sheaths, that, if present, are vestigial. This absence of leaf sheath fimbriae was noted by Tutin (1936) for other species of *Pariana* but only from Amazonia.

Both *Pariana lanceolata* and *P. carvalhoi* are endemic to the Brazilian state of Bahia, occurring within moist Atlantic forest. According to IUCN criteria (IUCN, 1994), *P. carvalhoi* should be considered "critically endangered," with only a few populations known, all occurring outside preservation areas. Although many field trips were made to different areas in Bahia, additional populations of the new species have not been found.

Paratypes. BRAZIL. **Bahia:** Una, estrada Una a São José, 18 Feb. 1994, *A. M. Carvalho et al. 4395* (CEPEC), 10 Feb. 1994, *A. M. Carvalho et al. 4384* (CEPEC); Fazenda Dendaevea, 30 km from Una, 28 Apr. 1976, *C. E. Calderón et al. 2403* (CEPEC).

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New Taxa of *Calyptranthes* (Myrtaceae) from Colombia

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ABSTRACT. Two new species (*C. buchenavioides*, *C. estoraquensis*) and one new subspecies (*C. lozanoi* subsp. *tomentosa*) of *Calyptranthes* (Myrtaceae) from Colombia are described and illustrated. The taxonomic affinities and the distribution of the new taxa are discussed.

Key words: *Calyptranthes*, Colombia, Myrtaceae.

Calyptranthes Swartz is a genus of ca. 100 species in Myrtaceae, distributed from Florida (United States), the Caribbean, and Mexico to northern Argentina and Uruguay (Legrand, 1962; McVaugh, 1958, 1963; Sánchez-Vindas, 1990). The genus is distinguished by frequently dibrachiate trichomes, inflorescence usually a pair of panicles, calyptrate calyx, 2(–3)-locular ovary, and myrcioid embryo (Landrum & Kawasaki, 1997; Holst, 2002). In a preliminary study of the genus for the Colombian flora, two new species and a new subspecies of *Calyptranthes lozanoi* C. Parra-O. were recognized as undescribed.

Calyptranthes buchenavioides C. Parra-O., sp. nov. TYPE: Colombia. Valle del Cauca: "Hoya del río Cali, vertiente derecha, entre Puente Sofía y Yanaconas," 1580–1730 m, 6 Nov. 1944 (fr), *J. Cuatrecasas 19725* (holotype, F). Figure 1.

Arbor 3–4 m alta; ramulis juvenilibus subteretibus, parce pubescentibus, vetustis teretibus, glabratis. Folia petiolata, petiolo 0.6–1.6 mm longo; lamina coriacea, supra glabra, subtus glabrata, obovata, 1.3–2.6 × 0.7–1.4 cm, apice obtusata, basi attenuata, costa supra impressa, glabra, subtus convexa, tantum per proximalem unam tertiam partem parce pilosa. Inflorescentia et flores non visi. Fructus globosus, diametro 1.0–1.3 cm.

Tree, 3–4 m tall, almost glabrous; trichomes when present pale gray (except in the embryo); young branches terete or subterete, sparsely pubescent; old branches terete, glabrous; vegetative buds lanceolate or conical, 0.8–1.1 mm long, pubescent. Leaf blades obovate, 1.3–2.6 × 0.7–1.4 cm, coriaceous, the upper surface glabrous, with impressed glandular dots, the lower surface glabrous; apex obtuse, sometimes slightly apiculate; base attenuate; midvein convex above, glabrous, convex below, sparsely pilose only in the proximal ⅓; lateral veins 7 to 11 pairs (almost imperceptible), sulcate above, impressed below, joining in a straight marginal vein at 0.5 mm from the margin; petiole 0.6–1.6 mm long, barely rugose, glabrous or sparsely pubescent, slightly canaliculate. Inflorescence terminal, apparently a panicle, the axes terete or subterete, glabrous; bracts ovate, 0.5 × 0.3–0.4 mm, pubescent, deciduous; bracteoles unknown. Buds and flowers unknown; calyptra (persistent in the fruit) discoid, ca. 1.4 mm diam., without prominent apiculum, glabrous. Fruits globose, blackish, 1–1.3 cm diam., exocarp smooth, glabrous; seeds 1, reniform, 1–1.1 × 0.9–1 cm, seed coat papyraceous, pale orange, smooth, without glands; embryo myrcioid, lower portion of the hypocotyl and portions of the cotyledons densely pubescent with long (1.2–1.5 mm) gray trichomes mixed with short (ca. 0.5 mm) red trichomes.

The specific epithet refers to the striking vegetative similarity (profuse ramification, opposite, obovate, and coriaceous leaves, and similar size of the leaves) between this new species and some species of *Buchenavia* Eichler (Combretaceae), especially with *Buchenavia tetraphylla* (Aublet) R. A. Howard and *Buchenavia parvifolia* Ducke.

Calyptranthes buchenavioides is known from coastal and premontane forest of the western Andean Cordillera in Colombia. Despite the lack of complete inflorescences of the studied specimens, other characters such as the calyptra (falling as a unit), the circular scar at the top of the fruit, and the myrcioid embryo place it in *Calyptranthes*.

Calyptranthes buchenavioides is somewhat similar to *Calyptranthes pulchella* DC., a species known from Colombia to Brazil. The leaves of the species are similar in shape (obovate blades) and size. *Calyptranthes buchenavioides* differs from *Calyptranthes pulchella* by the terete or subterete (vs. 2-winged) branchlets, the base of the leaf blades attenuate (vs. acute or cuneate), and the diameter of the calyptra (ca. 1.4 mm vs. 2–3 mm).

Paratypes. COLOMBIA. **Valle de Cauca:** "Punta Arenas, north shore of Buenaventura Bay, near sea level,"

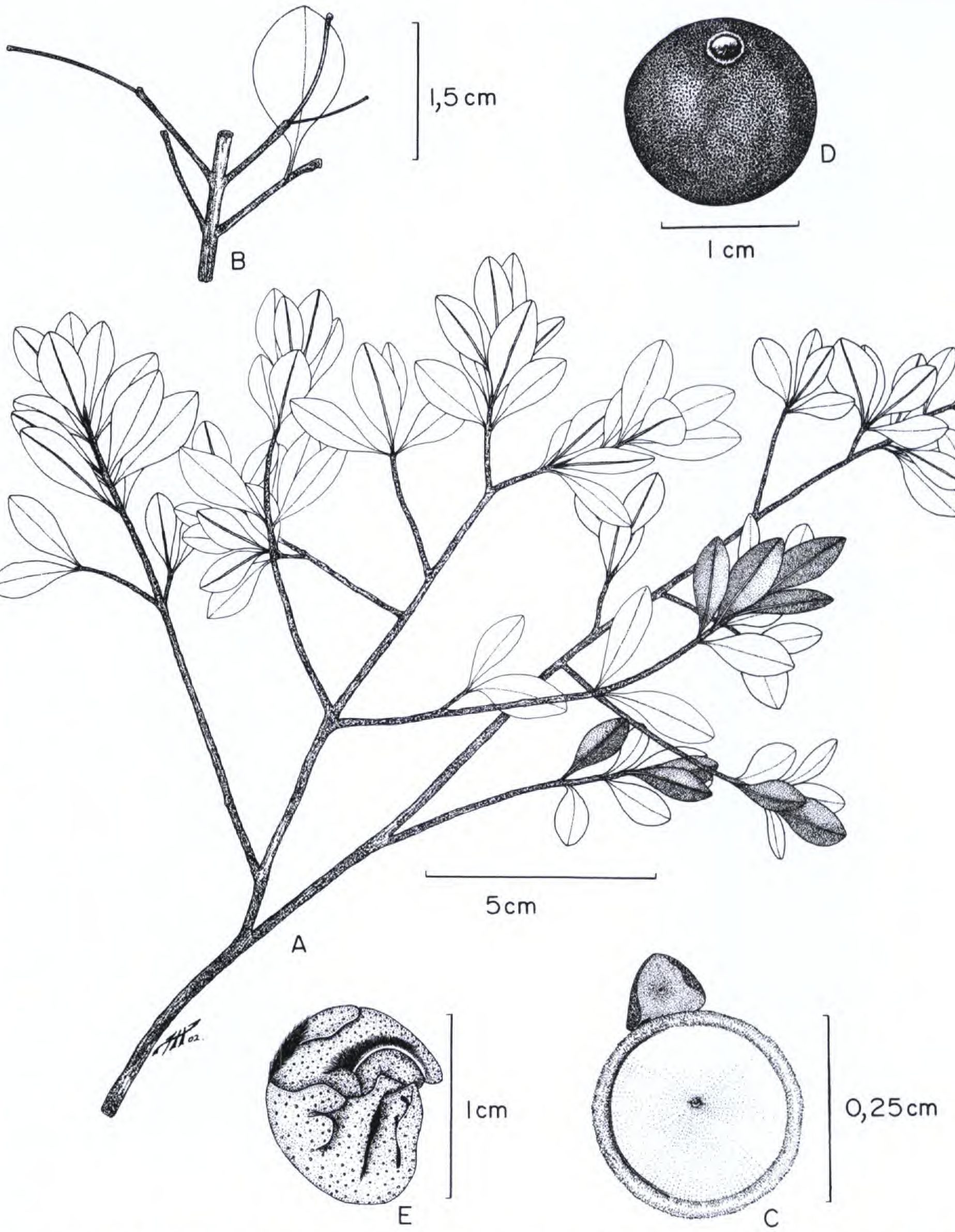

Figure 1. *Calyptranthes buchenavioides* C. Parra-O. —A. Vegetative branch. —B. Detail of a partial inflorescence. —C. View of the calyx scar on the fruit apex, showing the attached calyptra. —D. Fruit. —E. Embryo. (A, C–E, from the holotype, *Cuatrecasas 19725*; B, *Cuatrecasas 38628* (F paratype).)

2 June 1944, *E. P. Killip & J. Cuatrecasas 38628* (COL, F).

Calyptranthes estoraquensis C. Parra-O., sp. nov. TYPE: Colombia. Norte de Santander: La Playa de Belén, "vereda Peritama, Área Natural Única Los Estoraques," 1650 m, 20 Feb. 2002 (fr), *R. Galindo, J. Peñuela & E. Rodríguez 689* (holotype, COL; isotype, MO). Figure 2.

Arbor 5 m alta; ramulis juvenilibus subteretibus, parce pubescentibus, vetustis teretibus, glabratis. Folia petiolata, petiolo 3.8–5.5(–7.6) mm longo; lamina coriacea, supra glabra vel puberula, subtus pubescente, obovata, 5.0–7.3 × 3.1–4.7 cm, apice obtusata, basi cuneata, costa supra impressa, tantum per proximalem unam tertiam partem pubescente, subtus convexa, dense pubescente. Inflorescentia paniculata, 4–6 cm longa, dense pubescens; pedicello nullo. Flos alabastro obovoideo, 2.3–2.6 mm longo; calyptra 2.0–2.2 mm diam.; staminibus (1.6)2.1–3.1 mm longis; ovario 2-loculari. Fructus globosus, diametro 5.5–7.9 mm.

Tree, 5 m tall; trichomes when present light reddish brown; young branches subterete, subcompressed, sparsely pubescent, the light reddish

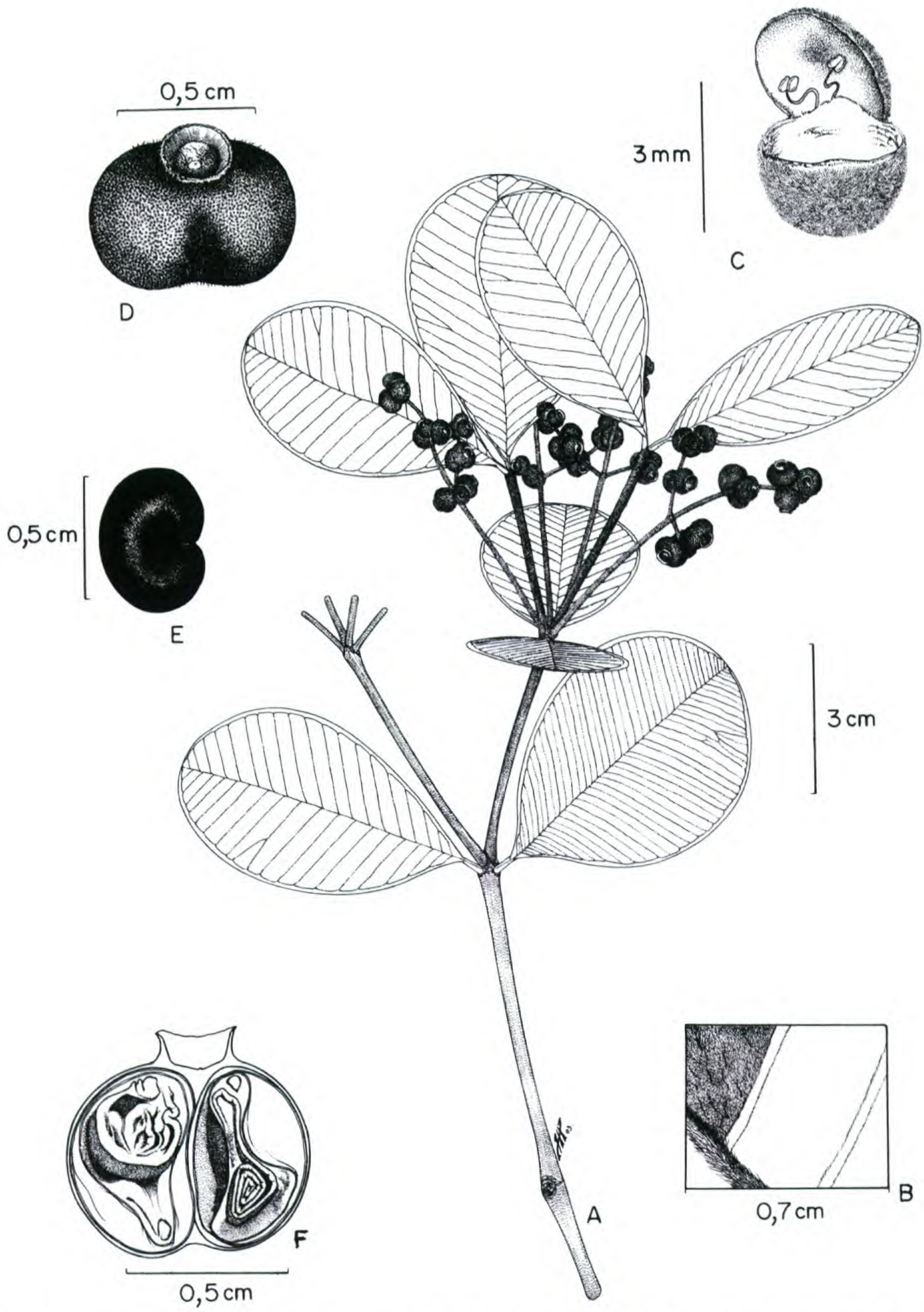

Figure 2. *Calyptranthes estoraquensis* C. Parra-O. —A. Fruiting branch. —B. Detail of the leaf blade pubescence (lower surface). —C. Flower, after anthesis. —D. Fruit. —E. Seed. —F. Longitudinal section of the fruit and seeds showing the embryo. (A, B, D–F, from the holotype *Galindo et al. 689*; C, *Galindo et al. 1168* (COL paratype).)

brown trichomes mixed with gray trichomes, the gray ones located mostly in the margins and apex of the branches; old branches terete, glabrous; vegetative buds semi-elliptic, 1.4–1.5 mm long, pilose. Leaf blades obovate, 5–7.3 × 3.1–4.7 cm, coriaceous, the upper surface glabrous to puberulous, sometimes with whitish trichomes, with impressed glandular dots, the lower surface pubescent; apex obtuse; base cuneate; midvein sulcate above, pubescent only in the proximal ⅓, convex below, densely pubescent; lateral veins 17 to 35 pairs in addition to weaker intermediates, convex on both surfaces, joining in a straight marginal vein at 1.4 mm from the margin; petiole 3.8–5.5(–7.6) mm long, rugose, puberulous with gray or mixed gray and light reddish brown trichomes (petioles of

leaves near the inflorescences are densely pubescent with light reddish brown trichomes), canaliculate. Inflorescence axillary or terminal, the paired and opposite panicles 4–6 cm long, with 20 to 30 flowers per panicle, the axes subterete or compressed, densely pubescent; peduncles 2.7–3.3 cm × 1.7–2.4 mm; bracts lanceolate, ca. 4.5 × 2 mm, pubescent, truncate in the base, deciduous; bracteoles (1)2, the larger one at the base of the hypanthium, ovate, ca. 0.7 × 0.3 mm, pubescent, deciduous or persistent after anthesis, the smaller one incompletely surrounding the base of the hypanthium, squamiform, ca. 0.5 × 0.9 mm, pubescent, persistent after anthesis. Flower buds obovoid, 2.3–2.6 mm long, pubescent, sessile; calyptra discoid, 2–2.2 mm diam., without prominent apiculum, pubescent; petals absent; hypanthium 1.8–2.1 × 2.6–2.9 mm, prolonged 0.7–0.8 mm above the ovary, pubescent outside, glabrous inside; style generally not developed, when occasionally developed, 1.2 mm long, glabrous; filaments (1.4)1.9–2.9 mm; anthers globose, 0.2 mm long, bearing one apical gland; ovary 1 mm diam., 2-locular, 1 ovule per locule. Fruits globose, dark wine-red, 5.5–7.9 mm diam., exocarp smooth, sparsely to moderately pubescent; seeds 2, reniform, 4.8–5.8 × 2.8–4.2 mm, seed coat papyraceous, orange, smooth, without glands; embryo myrcioid, glabrous.

Calyptranthes estoraquensis is only known from the Colombian Natural Area named "Estoraques," a semidesert landscape (badlands) made of rock formations caused by erosion. Estoraques is located at the eastern Andean Cordillera in Norte de Santander Department, between 1450 and 1900 m. At present, this particular area is included in the National Park System as a protected area, but the population of the species there seems to be small, "with only a few individuals" (R. Galindo, pers. comm. 2002).

Calyptranthes estoraquensis seems to be related to *Calyptranthes brasiliensis* Sprengel, and especially with *Calyptranthes brasiliensis* var. *mutabilis* (Berg) Legrand. A specimen of *C. brasiliensis* var. *mutabilis* from Brazil, *Duarte 9152* (MO), exhibits some degree of similarity with the specimens of *C. estoraquesis* from Colombia, particularly in the vegetative morphology (trichomes light reddish brown in young branches and petioles, and similar size of the petioles). The pubescence of the adaxial leaf blade and the inflorescence and the size of the inflorescence are also common characteristics of these two taxa. Nevertheless, *Calyptranthes estoraquensis* differs from *Calyptranthes brasiliensis* var. *mutabilis* by its leaf base (cuneate vs. rounded), the laminae (obovate vs. ovate or ovate-oblong) and the size of the fruit (5.5–7.9 mm vs. 4–4.5 mm).

Paratype. COLOMBIA. **Norte de Santander:** La Playa de Belén, "vereda Peritama, Área Natural Única Los Estoraques," 1550 m, 26 Feb. 2003 (fl), *R. Galindo, J. Peñuela & E. Rodríguez 1168* (COL).

Calyptranthes lozanoi C. Parra-O. subsp. **tomentosa** C. Parra-O., subsp. nov. TYPE: Colombia. Antioquia: Guarne, Laguna de Guarne, 20 July 1938 (bud, fr), *Bro. Daniel 2258* (holotype, US; isotype, COL). Figure 3.

Haec subspecies a *Calyptranthe lozanoi* subsp. *lozanoi* alabastris ellipsoideis vel late ellipsoideis (nec obovoideis), ramulis, petiolo, foliis (subtus), inflorescentia et alabastris modice vel dense pubescentibus (nec parce pubescentibus trichomatibus albis vel glabratis, interdum glabris), atque fructu bullato (nec laevi), exocarpio sparsim pubescente (nec glabro) differt.

Shrub, 2–4 m tall; trichomes when present yellowish or blackish; young branches subcompressed, sparsely to densely pubescent, sometimes almost blackish; old branches terete, glabrous; vegetative buds lanceolate or elliptic, 2.2–4.1 mm long, pubescent. Leaf blades obovate, sometimes broadly elliptic, 3.2–5.2(–6) × 1.6–3.1(–4) cm, coriaceous, the upper surface glabrous to sparsely puberulous, with impressed glandular dots, the lower surface sparsely to densely pubescent; apex acute or obtuse; base cuneate; midvein convex above, puberulous to sparsely pubescent in the proximal ⅓, convex below, moderately to densely pubescent; lateral veins 15 to 18 pairs, convex on both surfaces; marginal veins 2, the inner one 0.9–1.1 mm from the margin, the outer one ca. 0.4 mm from the margin; petiole 2.6–6.1(–8) mm long, blackish, lightly rugose, sparsely to densely pubescent (petioles of leaves near the inflorescences are densely pubescent with yellowish trichomes), canaliculate. Inflorescence subterminal, the paired and opposite panicles 3.5–7 cm long, with 12 to 25 flowers per panicle, the axes subterete or compressed, densely pubescent, sometimes almost blackish, rarely glabrous; peduncles 2.2–4 cm × 1.3–1.7 mm; bracts dimorphic, either lanceolate, ca. 6 × 2 mm, pubescent with yellowish trichomes, deciduous, or obovate, 1.2–1.7 × 0.4–0.5 cm, persistent; bracteoles 2, opposite at base of hypanthium, pubescent, deciduous or persistent after anthesis, the larger one lanceolate, 2.8–3.4 × 1–1.2 mm, the smaller one elliptic, 1.7–2.8 × 0.6–0.8 mm. Flower buds ellipsoid or widely ellipsoid, 4.6–6.4 mm long, pubescent, sometimes almost blackish, rarely glabrous, on pedicel 0.8–1.3 × 0.7–0.9 mm, densely pubescent, rarely glabrescent; calyptra discoid, 3–3.5

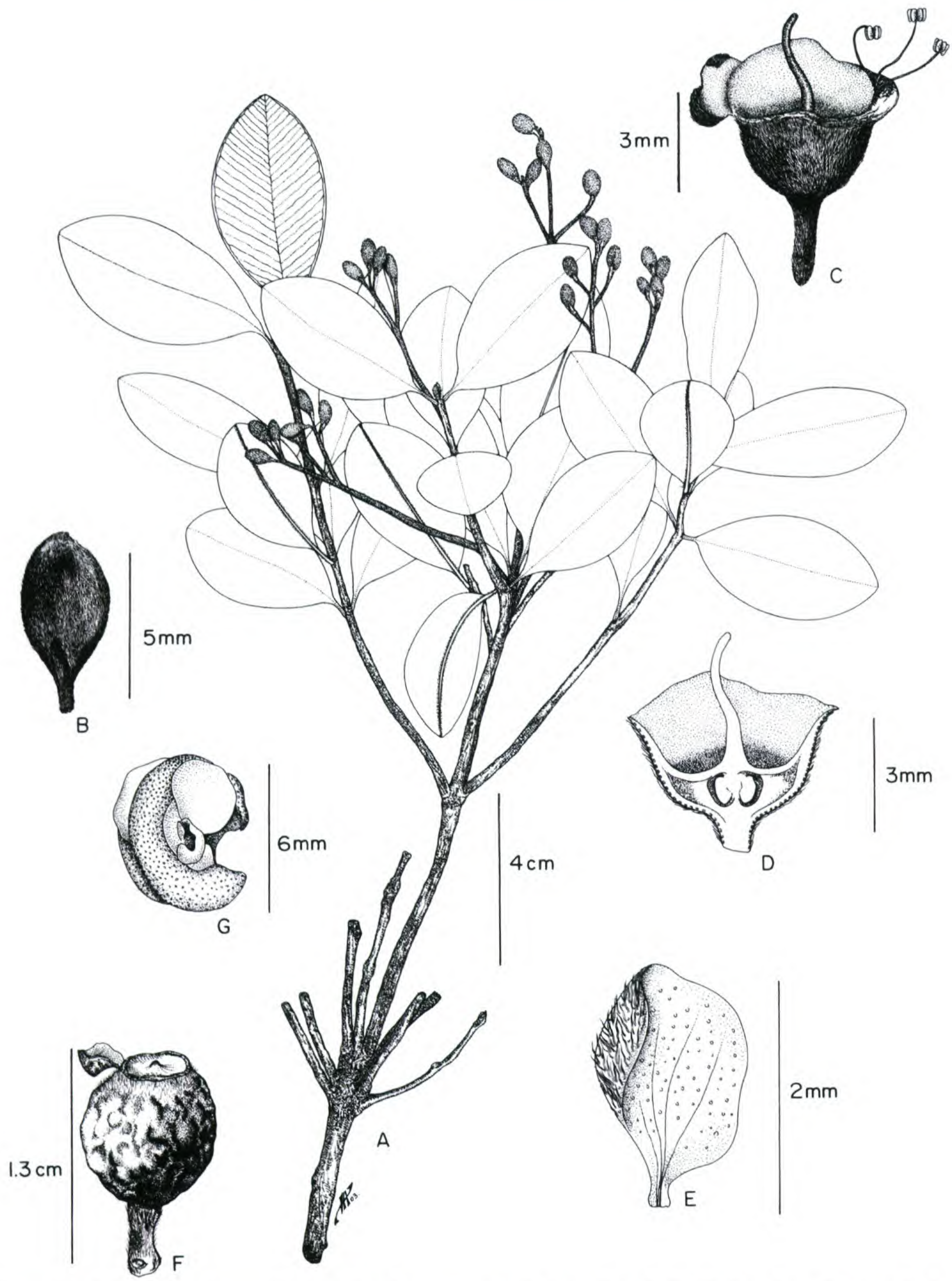

Figure 3. *Calyptranthes lozanoi* C. Parra-O. subsp. *tomentosa* C. Parra-O. —A. Fertile branch. —B. Flower bud. —C. Flower, after anthesis. —D. Longitudinal section of hypanthium and ovary. —E. Petal. —F. Fruit. —G. Embryo without seed coat. (A, B, F, G, from the holotype *Bro. Daniel 2258*; C–E, *Cabrera 254* (COL paratype).)

mm diam., weakly to prominently apiculate, generally pubescent, rarely glabrous; petals present, attached to the inner portion of the calyptra, 2 or 3 (early deciduous at anthesis), obovate, 2.2 × 1.1 mm, dorsally densely pubescent with white trichomes; hypanthium 2.5–3 × 4.1–4.7 mm, prolonged 1.3–1.6 mm above the ovary, pubescent outside, glabrous inside; style 4–5.5 mm long, glabrous; stamens 50–150; filaments 2.2–6 mm; anthers globose, 0.2–0.3 mm long, without apical glands; ovary 1.5 mm diam., 2-locular, 1 ovule per locule. Fruits globose, light brown, 8 mm diam., exocarp bullate, sparsely pubescent with whitish trichomes; seeds 2, reniform, 5.4–6 × 5 mm, seed coat papyraceous, red, smooth, without glands; embryo myrcioid, glabrous.

The subspecific epithet refers to the yellowish or blackish tomentum of the plant that varies from moderately dense to dense on twigs, leaves (petiole and lower surface of the blade), inflorescence, and flower buds. *Calyptranthes lozanoi* subsp. *tomentosa* is known only from the montane forest of the Central Andes Cordillera in Colombia.

In 2001 I described *Calyptranthes lozanoi* (Parra-O., 2001) as a conspicuous species from the Sierra Nevada de Santa Marta (Colombia), an isolated coastal mountain separated from the Andes Cordillera by plains and semiarid regions. The specimens cited here for the description of the new subspecies are similar to the specimens collected in Sierra Nevada de Santa Marta by the obovate leaf blade (and also in its size), the size of the panicles, the size of the hypanthium, the pubescence of petals, and the size of the fruit. Also, the vegetative morphology of all the specimens strikingly resemble the general aspect of *Myrcianthes* O. Berg species that grow in the montane forests of Colombia (Parra-O., 2001).

Calyptranthes lozanoi subsp. *tomentosa* differs from the typical subspecies by the ellipsoid or widely ellipsoid (vs. obovoid) flower buds, the moderate to dense yellowish or blackish pubescence (vs. sparse whitish pubescence or glabrescent, to often glabrous) of the twigs, petioles, lower surface of the leaf blade, inflorescence, and flower buds (vs. sparse whitish pubescence or glabrescent, to often glabrous), and the bullate, sparsely pubescent fruits (vs. smooth and glabrous).

Paratypes. COLOMBIA. **Antioquia:** Medellín, "Hoya de la Estación Experimental Forestal 'Piedras Blancas,' " June–Oct. 1957 (fl), *I. Cabrera 86* (COL, MEDEL), *I. Cabrera 254* (COL, MEDEL); Medellín-Guarne, "Parque Ecológico Piedras Blancas, laguna de Guarne," 75°29′W, 6°18′N, 2350 m, 22 July 1995 (fl), *F. Roldán et al. 2354* (HUA, MO).

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New Species and Combinations in *Astragalus* (Leguminosae) from China and the Himalayas

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ABSTRACT. Ten new species of *Astragalus* are described here. They belong to the following sections: section *Alopecuroidei*: *A. burqinensis*; section *Brachycarpus*: *A. barclayanus*, *A. golubojensis*, *A. mieherorum*, *A. nanshanicus*, *A. pseudojagnobicus*, *A. sagastaigolensis*; section *Hemiphaca*: *A. nigrodentatus*; section *Polycladus*: *A. tibeticola*; section *Skythropos*: *A. griersonii*. Furthermore, six taxa are raised in rank.

Key words: *Astragalus*, Bhutan, China, Leguminosae, Nepal.

In preparing the treatment of *Astragalus* L. for the English version of the *Flora of China*, several new species could be detected and furthermore some taxa, formerly described as varieties, were found to be good species. In the present paper the new species are described and the formal combinations are made. The flora of China is very rich in *Astragalus* species. In the *Flora*, 357 species, of which 189 are endemic in China, will be treated.

Astragalus L. sect. **Alopecuroidei** DC., Prodr. 2: 294. 1825. TYPE: *Astragalus alopecuroides* L.

Astragalus burqinensis Podlech & L. R. Xu, sp. nov. TYPE: China. Prov. Xinjiang: Burqin, 600 m, 24 July 1998, *L. R. Xu 2029* (holotype, MSB).

Differt ab *A. alopecuro* planta in partibus vegetativis glabra vel sub stipulis tantum sparse pilosa, petiolo 2.5–7 cm (nec 1–3 cm) longo, foliolis 13–15-jugis (nec 17–27-jugis), late ovatis, 12–30 × 10–22 mm, apice rotundata vel leviter emarginata (nec anguste ovata, (10–)20–35(–40) × (6–)10–13(–20) mm, apice obtusa ad subacuta), bracteolis deficientibus, vexillo 27–28 mm longo, dorso piloso (nec ca. 20 mm longo, glabro), laminis carinae ca. 15 × 8–9 mm (nec 7 × 3.5 mm), leguminibus ca. 14 mm (nec ca. 7 mm) longis, ab *A. pseudovulpino* planta in partibus vegetativis glabra vel sub stipulis tantum sparse pilosa, bracteolis deficientibus, laminis carinae 8–9 mm (nec 4–5 mm) latis.

Plants more than 30 cm tall (lower parts are missing). Stem erect, finely sulcate, glabrous or just below the stipules and at the base of stipules sparsely hairy. Stipules ca. 15 mm long, narrowly triangular, shortly adnate to the petiole. Leaves 20–30 cm long: petiole 2.5–7 cm long, finely striate-sulcate. Leaflets in 13 to 15 pairs, widely ovate, 12–30 × 10–22 mm, at the apex rounded to slightly emarginate. Peduncle very short, up to 1 cm long, densely covered with spreading hairs 1–2 mm long. Racemes (in fruit) cylindric, 7–9 cm long, densely many-flowered; axis loosely covered with spreading hairs. Bracts linear-acute, 12–18 mm long, ciliate at the margins with spreading hairs 1.5–2.5 mm long. Bracteoles absent. Flowers subsessile. Calyx 12–19 mm long, campanulate, densely covered with ascending to spreading hairs 2–5 mm long; teeth subulate, 5–7 mm long, Petals yellow. Standard 27–28 mm long; blade elliptic, ca. 9 mm wide, emarginate at the apex, at the base subabruptly narrowed into the long claw. Wings unknown. Keel ca. 27 mm long; blades triangular, with gibbously curved lower edge and ± straight upper edge, obtuse at the apex, ca. 15 × 8–9 mm; auricle acute, ca. 1 mm long, claw ca. 13 mm long. Legumes sessile, oblong, 12–14 mm long, 7–9 mm high and 4–7 mm wide, obtusely carinate ventrally, slightly grooved dorsally, abruptly contracted at the apex into a beak ca. 2 mm long, bilocular; valves netlike rugulose, loosely covered with subappressed soft hairs up to 3 mm long. Seeds 3 × 2–3 mm, dark brown, smooth.

Astragalus burqinensis differs from *A. alopecurus* Pallas by having vegetative parts glabrous or sparsely hairy only, by the petiole 2.5–7 (vs. 1–3) cm long, the leaflets in 13 to 15 (vs. 17 to 27) pairs, widely ovate, 12–30 × 10–22 mm, rounded or slightly emarginate (vs. narrowly ovate, (10–)20–35(–40) × (6–)10–13(–20) mm, obtuse to sub-

acute), bracteoles absent, standard 27–28 mm long, hairy on the back-side (vs. ca. 20 mm long, glabrous), limbs of keel ca. 15 × 8–9 mm (vs. 7 × 3.5 mm), legumes ca. 14 (vs. ca. 7) mm long, from *A. pseudovulpino* N. Ulziykhutag by being in vegetative parts glabrous or only below the stipules sparsely hairy, bracteoles absent and limbs of keel 8–9 (vs. 4–5) mm wide.

Astragalus sect. **Ammodendron** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11(16): 128. 1868. TYPE: *Astragalus ammodendron* Bunge.

Astragalus macrostephanus (S. B. Ho) Podlech & L. R. Xu, stat. nov. Based on *Astragalus iliensis* Bunge var. *macrostephanus* S. B. Ho, Bull. Bot. Res. North-East. Forest. Inst. 3(1): 68. 1983. TYPE: [China.] Xinjiang: Kazak Zizhizhou, Huocheng Xian, Sandohezi, 540 m, 14 June 1959, *A. R. Li & J. N. Zhu 10619* (holotype, PE; isotype, WUK).

Because of the very short original diagnosis of this taxon a complete description is given here.

Astragalus macrostephanus differs from *A. iliensis* by stems of the current year up to 30 (vs. up to 20) cm long, leaves 8–12 (vs. 3–5) cm long, petiole 4–5 (vs. 0.5–1) cm long, leaflets in 3 pairs (vs. in 1 or 2 pairs), 12–25 (vs. 20–40(–50)) mm long, peduncles 6–10 (vs. 2–5) cm long, calyx 5–6 mm long, rather densely covered with medifixed, appressed hairs 0.3–0.4 mm long (vs. 3–4 mm long, densely covered with partly flexuose, asymmetrically bifurcate, subappressed to slightly ascending hairs), petals longer, standard ca. 13 (vs. 8–9) mm, wings 12 (vs. 7–8) mm, keel 10 (vs. 6–7) mm long, legumes 10–12 (vs. 4–5) mm long, 4–5 (vs. ca. 2) mm high and wide.

Plants suffruticose, ca. 35 cm tall, covered with medifixed, appressed white hairs. Caudex divided, with long subterranean stolons, covered with gray-brownish bark. Stems erect, branched, very densely covered with white hairs 0.3–0.6 mm long, shoots of the current year up to 30 cm long. Stipules whitish to pale brownish hyaline, 2–4 mm long, obliquely triangular, acute, adnate to the petiole for ca. 1 mm, the lower ones distinctly vaginate-connate behind the stem, the upper ones mostly free, sparsely to loosely hairy, at the margins with strongly asymmetrically bifurcate to basifixed hairs, sometimes glabrescent with age. Leaves 8–12 cm long; petiole 4–5 cm long, like the rachis stout, at the base up to 1.5 mm thick, hairy like the stem. Leaflets in 3 pairs, narrowly elliptic to narrowly ovate, 12–25 × 3–5 mm, acute at the apex, on upper side loosely covered with hairs 0.6–0.8 mm long, on underside loosely to rather densely covered with somewhat shorter hairs. Peduncle 6–10 cm long, hairy like the stem. Raceme 5–12 cm long, very remotely 10- to 12-flowered. Bracts whitish to pale brownish hyaline, 1–1.5 mm long, narrowly triangular to narrowly ovate, sparsely white hairy. Pedicels ca. 1 mm long, hairy. Calyx 5–6 mm long, campanulate, rather densely covered with white hairs 0.3–0.4 mm long; teeth subulate, ca. 1 mm long. Standard ca. 13 mm long; blade ca. 5 mm wide, widely elliptic, emarginate at the apex, below the middle subabruptly contracted into the widely cuneate claw longer than the blade. Wings ca. 12 mm long; blades narrowly oblong, round-tipped, 6 × 1.5 mm; auricle short, claw ca. 6 mm long. Keel ca. 10 mm long; blades obliquely elliptic-curved, with widely curved lower edge and concave upper edge, obtuse at the apex, 4.5 × 2 mm; auricle short, claw 5.5 mm long. Ovary sessile, ovoid, densely hairy; style glabrous. Legumes sessile, ovoid, 10–12 mm long, 4–5 mm high and wide, obtusely carinate ventrally, widely grooved dorsally, acuminate at the apex into a curved beak ca. 1 mm long, nearly fully bilocular; valves thin but tough, densely villous with subbasifixed, ± spreading, tangled, fine, soft white hairs 2–3 mm long, mostly sitting on depressed tubercles.

Astragalus sect. **Brachycarpus** Boriss., Fl. URSS 12: 877. 1946. TYPE: *Astragalus melanostachys* Bentham (lectotype, designated by Podlech (1990: 466)).

Astragalus barclayanus Podlech, sp. nov. TYPE: Nepal. Tilicho Pass path, 4820 m, 7 June 1971, *C. Barclay & P. M. Synge 2620* (holotype, K).

Differt ab *A. chateri* planta pilis albis nigris immixtis 0.2–0.3(–0.5) mm longis, in inflorescentiis nigris ad 0.7 mm longis (nec pilis mere albis 0.3–0.8 mm longis) obtecta, stipulis 3–4 (nec 4–6) mm longis, breviter connatis vel superioribus liberis (nec ad medium connatis), foliolis supra glabris (nec sparse ad laxe pilosis), bracteis angustissime triangularibus, 2.5–3 mm longis (nec ovati-acuminatis, 3–5 mm longis), calyce 4 (nec 5–6) mm longo, pilis ascendentibus ad patentibus (nec subappressis) obtecto, vexillo 5–6 (nec 7–8) mm longo, ovario glabro (nec piloso).

Plants 7–12 cm tall, covered with subappressed to slightly ascending hairs 0.2–0.3(–5) mm long, in the inflorescence up to 0.7 mm long. Caudex with slightly elongated stolons provided with stipule-like bracts. Stems short, 3–5 cm long, prostrate to ascending, in lower part (the stolon part) glabrous, pale yellowish, in upper part (stem of the current year) rather densely covered with ± straight, subappressed to slightly ascending hairs, at the lowest

internode with mostly spreading white hairs, with a few black hairs mixed in. Stipules greenish, 3–4 mm long, the lower ones shortly connate behind the stem, the upper ones free. Leaves 2.5–4 cm long; petiole 0.5–1 cm long, like the rachis loosely covered with tangled, subappressed to ascending white and also black hairs. Leaflets in 7 to 9 pairs, narrowly elliptic, 4–7 × ca. 2 mm, at the apex mostly rounded, on upper side glabrous, on underside rather densely to densely covered with subappressed hairs up to 0.5 mm long, at the midvein and the tip often with black hairs mixed in. Peduncle 3–5 cm long, rather densely to densely covered with subappressed to ascending hairs, at the base mostly with white, in upper part mostly with predominantly black hairs. Raceme globular to ovoid, densely many-flowered, ca. 1.5 cm long. Bracts membranous, very narrowly triangular, 2.5–3 mm long, black hairy. Pedicels 0.5–1 mm long, black hairy. Calyx 4 mm long, campanulate, densely covered with ascending to spreading, tangled black hairs up to 0.6 mm long; teeth narrowly triangular, 1.5–2 mm long, densely black hairy on inner side. Petals pale pink and white. Standard 5–6 mm long; blade ca. 3.5 mm wide, widely elliptic, shallowly emarginate at the apex, very shortly narrowed at the base without distinct claw. Wings 4.5 mm long; blades obovate-spathulate, widely rounded at the apex, ca. 3 × 2 mm; auricle ca. 0.5 mm long, claw 1.5 mm long. Keel 4 mm long; blades oblique-elliptic, with widely curved lower edge and slightly curved upper edge, subacute at the apex, 2.5 × 1.5 mm; auricle indistinct, claws 1.5 mm long, connate for nearly the entire length. Stamen tube obliquely cut at the mouth. Ovary subsessile, ovoid, glabrous; style short. Legume unknown.

Astragalus barclayanus differs from *A. chateri* Vassilczenko by the indumentum of white and black hairs 0.2–0.3(–0.5) mm long, in the inflorescence of black hairs up to 0.7 mm long (vs. of only white hairs 0.3–0.8 mm long), by stipules 3–4 (vs. 4–6) mm long, shortly connate or the upper ones free from each other (vs. all connate for half of the length), leaflets glabrous (vs. sparsely to loosely hairy) on upper side, bracts very narrowly triangular, 2.5–3 mm long (vs. ovate-acuminate, 3–5 mm long), calyx 4 (vs. 5–6) mm long, covered with ascending to spreading (vs. subappressed) hairs, standard 5–6 (vs. 7–8) mm long, ovaries glabrous (vs. hairy).

Astragalus golubojensis Podlech & L. R. Xu, sp. nov. TYPE: [China.] Prov. Xizang [Qinghai ?]: Kam [Qamdo], river Kam, river Goluboj, near Nry-tschgo, 3590 m, 25 July 1900, *Ladygin 358* (holotype, LE).

Differt ab *A. densifloro* planta pilis 0.2–0.3 mm (nec 0.4–0.5 mm) longis obtecta, caulibus ad 18 cm (nec 2–5(–7) cm) longis, sparsissime pilis albis nigrisque (nec laxe ad densiuscule pilis albis) obtectis, dentibus calycis anguste triangularibus 1–1.5 mm longis (nec subulatis, 1.5–2 mm longis), petalis in sicco albidis (nec pallide violaceis), vexillo ca. 8 mm longo et 5 mm lato (nec 6–7 mm longo et 3–3.5 mm lato), alarum laminis apice oblique emarginate (nec obtusa), ovario glabro (nec piloso).

Plants ca. 25 cm tall, covered with appressed hairs 0.2–0.3 mm long. Caudex up to 15 mm thick, branched. Stems up to 18 cm long, slender, prostrate to ascending or erect, angular-sulcate, furnished with scattered appressed white and black hairs. Stipules narrowly triangular, 3–4 mm long, very shortly adnate to the petiole, shortly vaginate-connate behind the stem, with scattered black hairs, at the margins with minute sesssile glands. Leaves 2.5–4 cm long, sessile; rachis distinctly grooved on upper side, loosely covered with appressed white hairs. Leaflets in 5 or 6 pairs, narrowly elliptic, 6–14 × 1–3 mm, obtuse to minutely emarginate at the apex, on upper side glabrous, on underside sparsely to loosely hairy, nearly always with uprolled margins or folded, often curved. Peduncle 3–9 cm long, sulcate, sparsely but below the raceme more densely white and predominantly black hairy. Raceme capitate to somewhat elongated, densely many-flowered. Bracts whitish membranous, narrowly triangular, 2–3 mm long, with subappressed to ascending predominantly black hairs. Flowers nearly sessile. Calyx ca. 3 mm long, campanulate, rather densely to densely covered with subappressed to slightly ascending predominantly black hairs; teeth narrowly triangular, 1–1.5 mm long. Petals in dry state whitish. Standard ca. 8 mm long; blade ca. 5 mm wide, widely elliptic, slightly emarginate at the apex, at the base narrowed without distinct claw. Wings ca. 7 mm long; blades narrowly oblong, obliquely laterally incised at the apex, 4.5 × 1.2 mm; auricle ca. 0.5 mm long, claw 2 mm long. Keel 5 mm long; blades obliquely obovate, with lower edge rectangularly curved in distal part and upper edge straight, subobtuse at the apex, 3 × 1.5 mm; auricle ca. 0.3 mm long, claw 2 mm long. Stamen tube truncate at the mouth. Ovary shortly stipitate, glabrous. Legume unknown.

Astragalus golubojensis differs from *A. densiflorus* Karelin & Kirilow by hairs 0.2–0.3 (vs. 0.4–0.5) mm long, the stems up to 18 (vs. 2–5(–7)) cm long, covered very sparsely with white and black hairs (vs. loosely to rather densely with only white hairs), petals whitish (vs. pale violet) when dry, standard ca. 8 × 5 mm (vs. 6–7 × 3–3.5 mm), limbs of

wings obliquely emarginate at the tip (vs. obtuse) and the ovaries glabrous (vs. hairy).

Astragalus mieheorum Podlech & L. R. Xu, sp. nov. TYPE: China. Prov. Qinghai: Kunlun Shan, Kunlun Shankou, SW of Golmud, 4690 m, 35°41′N, 94°03′E, 2 Aug. 1993, *G. & S. Miehe 9392/08* (holotype, MSB).

Differt ab *A. densifloro* caule, rachidibus pedunculisque pilis oblique patentibus ad patentibus (nec appressis) 0.5–0.8 mm longis (nec 0.4–0.5 mm longis) obtectis, foliolis subtus pilis ascendentibus (nec appressis) obtectis, calyce 5–6 (nec 3–5) mm longo, vexillo late ovato, 8–9.5 mm longo et 5–6.5 mm lato (nec elliptica, 6–7 mm longa et ad 3.5 mm lata).

Plants 7–12 cm tall. Caudex with ± elongated, slender stolons partly subterranean, partly aerial. Stems 1–2 cm long, slender, prostrate to ascending, densely covered with ascending to spreading, white or black and white hairs 0.5–0.8 mm long. Stipules greenish, narrowly triangular, 3–6 mm long, adnate to the petiole for ca. 1 mm, the lower ones shortly vaginate-connate behind the stem, the upper ones nearly free from each other, sparsely predominantly black hairy, at the base of margins with minute sessile glands. Leaves 2–4(–5.5) cm long; petiole 0.5–1 cm long, with the rachis loosely to rather densely hairy like the stem. Leaflets in (3)4 to 6 pairs, narrowly elliptic, 5–14 × 1.5–4.5 mm, obtuse to acute at the apex, glabrous on upper side, on underside rather densely covered with tangled, ascending white hairs up to 1 mm long. Peduncle 2–4 cm long, densely covered with ascending to spreading, tangled white or black and white, sometimes only black hairs up to 1 mm long. Raceme ovate, 1.5–3 cm long, densely many flowered. Bracts white-membranous, linear-acute, 4–6 mm long, black hairy. Flowers nearly sessile. Calyx 5–6 mm long, campanulate, ± densely covered with ascending to nearly spreading, tangled black hairs up to 1 mm long; teeth subulate, (1.5–)2–3.5 mm long. Petals violet, in dry state often pale yellowish brown. Standard 8–9.5 mm long; blade widely ovate, 5–6.5 mm wide, widely retuse to slightly emarginate at the apex, at the base subabruptly narrowed into the cuneate claw. Wings 6.5–7(–8) mm long; blades narrowly oblong, gradually widened toward the truncate-incised apex, 4–4.5 × 2–2.2 mm; auricle minute, claw 2.5–3 mm long. Keel 5.5–6 mm long; blades oblique-obovate, with widely nearly rectangular-curved lower edge and nearly straight upper edge, subacute at the apex, ca. 3 × 2 mm; auricle minute, claws 2.5–3 mm long, connate for nearly the entire length. Stamen tube truncate at the mouth. Ovary sessile to subsessile, widely ovate to nearly globular, white hairy; style thick, short, glabrous. Legume sessile, globose, ca. 4 mm thick, rounded at the apex without beak but with the persistent glabrous style, bilocular; valves densely covered with ascending to spreading, tangled, partly straight partly curly white and black hairs up to 1 mm long. Seeds probably two.

Astragalus mieheorum differs from *A. densiflorus* Karelin & Kirilow by the stem, rachis, and peduncle covered with ascending to spreading hairs 0.5–0.8 mm long (vs. by appressed hairs 0.4–0.5 mm long), by leaflets covered on the underside with ascending (vs. appressed) hairs, by the calyx 5–6 (vs. 3–5) mm long, and by the standard widely ovate, 8–9.5 mm long and 5–6.5 mm wide (vs. elliptic, 6–7 mm long and up to 3.5 mm wide).

Etymology. Named after Prof. G. Miehe and Mrs. S. Miehe, University of Göttingen, explorers of the vegetation of Tibet.

Paratypes. CHINA. **Qinghai:** Kunlun Shan, Kunlun Shankou, SW of Golmud, 4870 m, 35°40′N, 94°03′E, 3 Aug. 1993, *G. & S. Miehe 9394/06* (MSB); Kunlun Shan, E of Kunlun Shankou, SW of Golmud, 4820 m, 35°41′N, 94°14′E, 1 Aug. 1993, *G. & S. Miehe 9374/14* (MSB); NE Tibet, Northeastern Plateau along Golmud–Lhasa highway, Kunlun Shankou-Qumar Heyan, 4570 m, 35°30′N, 93°45′E, 3 Aug. 1993, *G. & S. Miehe 9403/12* (MSB); between Madoi and Bayanka La, 4450 m, 34°20′N, 97°55′E, 3 Aug. 1998, *G. Miehe, J. Q. Liu & Sonamco 98-35221* (MSB).

Astragalus nanshanicus Podlech & L. R. Xu, sp. nov. TYPE: China. Prov. Qinghai: Qinghai Nan Shan, Caka Basin, 36°40′N, 98°45′E, 3520 m, 27 July 1993, *G. & S. Miehe 9329/07* (holotype, MSB).

Differt ab *A longiracemoso* stipulis 2.5–3 (nec 3–7) mm longis, foliis 2–4.5 (nec 3–8) cm longis, 4–6 (nec 6–9) jugis, foliolis 4–8 × 1–3 (nec 9–27 × 2–7) mm, pedunculo mere albi-piloso (nec in parte superiore saepissime mere nigri-piloso), axi inflorescentiae albi-piloso (nec praecipue nigri-piloso), vexillo ca. 7 (nec 8–10) mm longo.

Plants tall, up to 30 cm or more, basal parts unknown. Stem up to 30 cm long, slender, loosely to rather densely covered with irregularly spreading white hairs and sometimes below the nodes with few black hairs 0.15–0.3 mm long. Stipules greenish, narrowly triangular, 2.5–3 mm long, free from petiole, loosely to rather densely covered with ascending to nearly spreading white, at the base also black hairs, at the base of margins with minute, sessile glands. Leaves 2–4.5 cm long; petiole 0.3–1 cm long, together with the rachis white hairy like the stem. Leaflets in 4 to 6 pairs, narrowly elliptic to narrowly ovate, 4–8 × 1–3 mm, rounded to slightly emarginate at the apex, on upper side gla-

brous, on underside rather densely covered with subappressed to ascending hairs up to 0.3 mm long, mostly folded. Peduncles 1–6 cm long, white hairy like the stem. Racemes at anthesis short, densely many-flowered, distinctly elongating in fruit; axis white hairy. Bracts whitish membranous, narrowly triangular, 2–2.5 mm long, sparsely black hairy. Pedicels 0.3–0.5 mm long, black hairy. Calyx 3 mm long, campanulate, obliquely cut at the mouth, rather densely covered with subappressed, black and white hairs up to 0.5 mm long; teeth narrowly triangular, 1–1.5 mm long, densely white hairy on inner side. Petals violet with darker tip of keel. Standard ca. 7 mm long; blade ca. 4.5 mm wide, widely elliptic, emarginate at the apex, gradually shortly narrowed at the base without a distinct claw. Wings ca. 5.5 mm long; blades obovate, widened toward the rounded apex, 3.5 × 2 mm; auricle 0.5 mm long, claw ca. 2 mm long, curved. Keel ca. 4 mm long; blades half-circular, with widely curved lower edge and straight upper edge, subacute at the apex, 2.5 × 1.5 mm; auricle minute, acute, claws ca. 1.5 mm long, connate for nearly the whole length. Stamen tube ± truncate at the mouth. Ovary sessile, nearly globular, glabrous; style thick, short. Legumes unknown.

Astragalus nanshanicus differs from *A. longiracemosus* N. Ulziykhutag by stipules 2.5–3 (vs. 3–7) mm long, leaves 2–4.5 (vs. 3–8) cm long, leaflets in 4 to 6 (vs. 6 to 9) pairs, 4–8 × 1–3 (vs. 9–27 × 2–7) mm, peduncles only white hairy (vs. in upper part mostly merely black hairs), inflorescence axis white (vs. predominantly black) hairy, standard ca. 7 (vs. 8–10) mm long.

Astragalus pseudojagnobicus Podlech & L. R. Xu, sp. nov. TYPE: China. Kaschgaria, Ugu, Ulug-tuz, valley of river Tscharlym, 28 June 1909, *Divanogorskaja 284* (holotype, LE).

Differt ab *A. jagnobico* stipulis petiolo vix adnatis, basalibus alte vaginanti-connatis (nec petiolo per 0.5–1 mm adnatis, inter se liberis), foliolis 4–6 (nec 6–9) jugis, vexillo ca. 10 mm longo et 5 mm lata (nec 5–6 mm longo et 2.2–2.5 mm lata), lamina alarum obovata, 4.5–5 × 2 mm (nec anguste oblonga, ca. 3 × 2 mm).

Plants up to 25 cm tall, with appressed to subappressed hairs 0.1–0.3 mm long. Caudex up to 15 mm diam., with a pluricipital root-crown. Stems several, prostrate to ascending, slender, striate-sulcate, sparsely to loosely covered with white, below the nodes also with black hairs. Stipules greenish, ovate to triangular, white and black hairy, nearly free from the petiole, the lower ones highly connate behind the stem, the middle and upper ones free from each other. Leaves 4–7 cm long; petiole 1–2.5 cm long, like the rachis slender, loosely covered with white and interspersed black hairs. Leaflets in 4 to 6 pairs, narrowly elliptic to elliptic, 5–12 × 3–6 mm, rounded to distinctly retuse at the apex, on upper side glabrous, on underside loosely to rather densely appressed white hairy. Peduncles 6–10 cm long, slender, ascending-curved, striate-sulcate, loosely covered in lower part with merely white hairs, in upper part also with increasing black hairs. Raceme at first globose-ovoid, soon elongating and up to 4 cm long, many-flowered. Bracts whitish membranous, narrowly triangular, 1.5–2 mm long, black hairy. Pedicels ca. 0.5 mm long, densely black hairy. Calyx 3–4 mm long, campanulate, obliquely cut at the mouth, loosely to rather densely covered with black and few white hairs; teeth narrowly triangular, 1.2–1.5 mm long. Petals in dry state whitish to slightly pale-violet-suffused, standard sometimes with pale violet longitudinal nerves, keel in upper part mostly violet. Standard ca. 10 mm long; blade slightly obovate, ca. 5 mm wide, slightly emarginate at the apex, gradually narrowed at the base. Wings 7 mm long; blades obovate, widely rounded at the apex, 4.5–5 × 2 mm; auricle short, claw 2.5 mm long. Keel 5 mm long; blades obliquely obovate, lower edge curved in distal part and upper edge ± straight, subobtuse at the apex, 3.5 × 2 mm; auricle indistinct, claw ca. 1.5 mm long. Ovary ovoid. Legumes unknown.

Astragalus pseudojagnobicus differs from *A. jagnobicus* Lipsky by the stipules scarcely adnate to the petiole, the lower ones vaginate-connate high up (vs. adnate to the petiole for 0.5–1 mm, free from each other), leaflets in 4 to 6 (vs. 6 to 9) pairs, standard ca. 10 × 5 (vs. 5–6 × 2.2–2.5) mm, limbs of wings narrowly obovate, 4.5–5 × 2 mm (vs. narrowly oblong, ca. 3 × 2 mm).

Astragalus sagastaigolensis N. Ulziykhutag ex Podlech & L. R. Xu, sp. nov. TYPE: [China. Prov. Qinghai:] Dzhungaria, Sagastaigol, 2740 m, 5 Sep. 1879, *A. Regel* (holotype, LE).

Differt ab *A. imetensi* stipulis inter se liberis (nec foliorum inferiorum alte vaginati-connatis) foliolis 6–9-juga (nec 5–6-juga), bracteis 4–5 (nec 3) mm longis, vexillo 8.5–9.5 (nec 6–7) mm longo, lamina alarum obtriangulari apice distincte emarginata, ca. 2.5 mm lata (nec anguste oblonga apice obtusa, ca. 1.5 mm lata).

Plants ca. 15 cm tall. Caudex strong, up to 15 mm thick, with a pluricipital root-crown, with short branches. Stems many, up to 10 cm long, prostrate to ascending or erect, rather densely covered with appressed to subappressed white hairs 0.4–0.6 mm long, with some black hairs mixed in especially at

the nodes, glabrescent with age. Stipules whitish to slightly greenish, 4–6 mm long, free from the petiole and from each other, sparsely to loosely covered with subappressed, predominantly black hairs, at the margins with minute, sessile glands. Leaves 3–6 cm long, subsessile; rachis hairy like the stem. Leaflets in (5)6 to 9 pairs, narrowly elliptic, 8–15 × 2–5 mm, rounded to narrowly obtuse at the apex, on upper side glabrous, on underside rather densely covered with appressed white hairs 0.3–0.5 mm long. Peduncle 2.5–5 cm long, slightly angular-sulcate, white hairy like the stem, toward the raceme with increasing black hairs. Racemes 2–3 cm long, densely many-flowered; axis with ascending black hairs. Bracts whitish membranous, narrowly triangular, acuminate, 4–5 mm long, with subappressed to ascending, predominantly black hairs. Pedicels ca. 1 mm long, recurved, black hairy. Calyx 4–4.5 mm long, campanulate, loosely to rather densely covered with subappressed to ascending black hairs ca. 0.5 mm long; teeth subulate, ca. 2 mm long, black hairy on inner side. Petals whitish when dry. Standard 8.5–9.5 mm long; blade elliptic, ca. 4 mm wide, rounded at the apex, at the base subabruptly narrowed into the short claw. Wings ca. 7 mm long; blades obtriangular, distinctly dilated to the unequally widely emarginate apex, 4.5 × 2.5 mm; auricle ca. 0.3 mm long, claw 2 mm long. Keel 5 mm long; blades oblique-elliptic, with widely rectangular-curved lower edge and slightly curved upper edge, subobtuse at the apex, ca. 3 × 2 mm; auricle minute, claw 2 mm long. Ovary shortly stipitate, densely white hairy; style glabrous. Legumes sessile, globose, ca. 3 mm diam., rounded ventrally, deeply grooved dorsally, rounded at the apex, beakless, bilocular; valves pale brownish, rather densely covered with subappressed to slightly ascending white and black hairs up to 0.8 mm long. Seeds one in each locule, 2–2.5 mm long, pale brownish, smooth.

Astragalus sagastaigolensis differs from *A. imetensis* Borissova by the stipules all free from each other (vs. those of lower leaves vaginate-connate high up), leaflets in 6 to 9 (vs. 5 or 6) pairs, bracts 4–5 (vs. 3) mm long, standard 8.5–9.5 (vs. 6–7) mm long, limbs of wings obtriangular, distinctly emarginate, ca. 2.5 mm wide (vs. narrowly oblong, obtuse, ca. 1.5 mm wide).

Astragalus L. sect. **Cenantrum** Bunge, Mém. Acad. Imp. Sci. Saint Pétersburg 11(16): 23. 1868. TYPE: *Astragalus frigidus* (L.) A. Gray (lectotype, designated by Podlech (1990: 468)).

Astragalus purpurinus (Y. C. Ho) Podlech & L. R. Xu, stat. nov. Based on *Astragalus membranaceus* Bunge var. *purpurinus* Y. C. Ho, Bull. Bot. Lab. North-East. Forest. Inst. 1980(8): 54. 1880. TYPE: [China.] Gansu: Xiaho Xian [Hsiahohsien], 2600 m, 1 July 1937, *T. P. Wang 6925* (holotype, WUK).

Because of the short original diagnosis of this taxon a complete description is given here.

Astragalus purpurinus differs from *A. mongholicus* Bunge by the strong stem up to 8 (vs. 2.5–3) mm diam., shorter (4(–5) vs. 5–9 mm long) and more densely hairy calyx with shorter teeth (0.3–1 vs. 0.5–1.5 mm long), purple petals and legumes with a stipe only 4–5 (vs. 6–15) mm long.

Plants at least 60–70 cm tall, covered with hairs 0.3–0.5(–1.5) mm long. Stem erect, at the base up to 8 mm diam., angular-sulcate, glabrous or with scattered spreading hairs up to 1.5 mm long. Stipules green, very narrowly to narrowly triangular, free, the lower ones 8–10, the upper ones 4–5 mm long, glabrous or ciliate at the margin. Leaves 5–9 cm long, nearly sessile; rachis grooved on upper side, sparsely covered with spreading hairs up to 1 mm long. Leaflets in 3 to 9 pairs, narrowly ovate to narrowly elliptic, rounded to minutely acuminate at the apex, 10–17 × 3–7 mm, on upper side loosely covered with appressed to subappressed hairs 0.3–0.5 mm long, on underside loosely with appressed to subappressed hairs 0.5–1 mm long. Peduncles 5–13 cm long, sparsely to loosely covered with appressed to ± spreading white hairs. Racemes loosely many-flowered, 4–5 cm long, soon elongating and at least up to 10 cm long; raceme axis black hairy. Bracts green, linear-subulate, 5–8 mm long, ca. 0.5 mm wide, loosely mainly white ciliate. Pedicels 1–1.5 mm long, later on elongating and up to 3 mm long, with minute black hairs. Bracteoles whitish, linear, 0.5–1 mm long, in upper part of the pedicel. Calyx campanulate, 4(–5) mm long, slightly gibbous at the base, strongly obliquely cut at the mouth, the tube loosely covered with short black subappressed hairs up to 0.3 mm long and with few long white hairs, at the upper margin and the teeth more densely black hairy; teeth narrowly triangular to triangular, 0.3–1 mm long. Petals lilac or dark purplish at the apex and whitish at the base. Standard 13 mm long; blade distinctly recurved, obovate, 7 mm wide, emarginate at the apex, gradually and shortly cuneately narrowed at the base. Wings 13 mm long, distinctly bent at the base of the blade; blades narrowly oblong, rounded at the apex, 5 × 1.5 mm; auricle 0.8 mm long, claw 7–8 mm long, straight. Keel 12 mm long; blades strong-

ly curved-elliptic, with widely and nearly rectangularly curved lower edge and distinctly concave upper edge, obtuse at the apex, 5 × 2 mm; auricle ca. 0.3 mm long, claw 7 mm long. Stamen tube obliquely cut at the mouth. Ovary with a stipe ca. 5 mm long, densely white hairy. Legume with a slender stipe 4–5 mm long, narrowly elliptic, acuminate at both ends; valves loosely to densely covered with subappressed white and black hairs ca. 0.3 mm long, glabrescent with age and sometimes subglabrous.

Other specimen seen. CHINA. **Gansu:** Yuzhong, 2750 m, 8 Aug. 1959, *Y. He 5864* (WUK).

Astragalus xitaibaicus (K. T. Fu) Podlech & L.-R. Xu, stat. nov. Based on *Astragalus monadelphus* Bunge subsp. *xitaibaicus* K. T. Fu, Acta Bot. Bor.-Occ. Sin. 1(2): 17. 1981. TYPE: [China.] Shaanxi: Xitaiba Shan, Ding-peng-shan, 3300 m, *Fu Kun-tsun 10321* (holotype, WUK).

Because of the short original diagnosis of this taxon a complete description is given here.

Astragalus xitaibaicus differs from *A. monadelphus* by being totally glabrous with the exceptions of the inner side of the calyx teeth and sometimes the bracts (vs. at least hairy on underside of leaflets, calyx, and legumes) and by the presence of stipel-like entire or fringed, linear to narrowly triangular emergences 0.5–2.5 mm long and/or of distinctly stalked minute glands at the base of the leaflets.

Plants 12–22 cm tall, totally glabrous with the exception of the inner side of the calyx teeth and sometimes the bracts. Caudex strong, 15 mm thick, with a pluricipital root-crown. Stems several, ascending to erect, up to 4 mm thick, angular-striate, 10–17 cm long. Stipules greenish membranous with narrowly hyaline margins, ovate, obtuse, 12–15 mm long and up to 10 mm wide, connate at the base, free from the petiole. Leaves 4–8 cm long; petiole 0.7–2 cm long, at the base of the leaflets with stipel-like entire or fringed, linear to narrowly triangular emergences 0.5–2.5 mm long and/or with distinctly stalked minute glands. Leaflets in 5 to 7 pairs, ovate to elliptic, 10–18 × 5–9 mm, at the apex rounded and sometimes minutely mucronulate. Peduncles 4–7.5 cm long. Racemes 8- to 11-flowered. Bracts narrowly ovate, acute, ca. 10 mm long, sometimes sparsely ciliate at the margins. Pedicels 2–3 mm long. Calyx campanulate, 7.5–9 mm long; teeth subulate, 2.5–3 mm long, hairy on inner side. Petals yellow. Standard ca. 11 mm long; blade obovate, 5–6 mm wide, emarginate at the apex, at the base subabruptly contracted into the rather long claw. Wings ca. 11 mm long; blades narrowly oblong, obtuse at the apex, ca. 4 × 1.5 mm; auricle short, claw 6.5–7 mm long. Keel ca. 10 mm long; blades obliquely elliptic, ca. 3.5 × 2 mm; auricle indistinct, claw ca. 6.5 mm long. Stamen tube closed (monadelphous), slightly obliquely cut at the mouth. Ovary stipitate, hairy. Legumes with a stipe 5–6 mm long, narrowly elliptic, shortly attenuate at both ends, ca. 15 mm long, unilocular; valves hairy.

Paratype. CHINA. **Shaanxi:** Xitaibai Shan, Hun-ren-ping, in summo alpino, 3300 m, 4 July 1959, *Yang Jin-xiang 645* (WUK).

Astragalus sect. **Corethrum** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11(16): 98. 1868. TYPE: *Astragalus scoparius* C. A. Meyer (lectotype, designated by Podlech (1990: 471)).

Astragalus chaidamuensis (S. B. Ho) Podlech & L. R. Xu, stat. nov. Based on *Astragalus kronenburgii* B. Fedtschenko var. *chaidamuensis* S. B. Ho, Bull. Bot. Res. North-East. Forest. Inst. 3(1): 42. 1983. TYPE: [China.] Qinghai: Haixi Mongolzu Zangzu, Kazakzu Zizhizhou, Delingha, 3290 m, 21 July 1959, *Exped. Gansu et Qinghai Acad. Sin. 805* (holotype, WUK).

Because of the very short original diagnosis of this taxon a complete description is given here.

Astragalus chaidamuensis differs from *A. kronenburgii* B. Fedtschenko by stipules triangular, 2 mm long (vs. narrowly triangular, 3–5 mm long), adnate to the petiole for 0.5 (vs. 1–2) mm, densely hairy (vs. subglabrous to loosely hairy), leaflet in up to 4 (vs. in 3 to 6) pairs, peduncles 5–14 (vs. 9–22) cm long, only white (vs. toward the raceme increasingly black) hairy, raceme very short, 3- to 7-flowered (vs. 3–5 cm long, 10- to 16-flowered), bracts 1–2 (vs. 3–4) mm long, calyx 10 (vs. 5–6) mm long, teeth 2.2–3 (vs. 1–2) mm long.

Plants ca. 18 cm tall, nearly acaulescent, caespitose, covered in vegetative parts with medifixed, appressed white hairs 0.3–1 mm long. Caudex ca. 8 mm diam., at the apex strongly divided with short branches, covered with brown bark. Stems branched at the base, parts of the current year, if developed, up to 0.5 cm long, densely hairy. Stipules ca. 2 mm long, triangular, adnate to the petiole for ca. 0.5 mm, densely hairy. Leaves of sterile shoots 1–2 cm long; petiole 0.5–1 cm long, with 1 or 2 pairs of small leaflets, 2–3 mm long. Leaves of the flowering shoots 3–7 cm long; petiole 1–2 cm long, like the rachis slender, densely hairy. Leaflets in (2)3 to 4 pairs, linear, 10–15 × 1–1.5 mm,

acute-tipped, on both sides rather densely to densely hairy. Peduncles 5–14 cm long, loosely to rather densely white hairy. Racemes short, subumbellate, 3- to 7-flowered. Bracts membranous, narrowly triangular, 1–2 mm long, sparsely furnished with mostly basifixed white and black hairs. Pedicels ca. 0.5 mm long, white and black hairy. Calyx ca. 10 mm long, tubular, obliquely cut at the mouth, loosely to rather densely covered with medifixed appressed white hairs 0.5–1 mm long and mostly slightly shorter black hairs; teeth subulate, 2.2–3 mm long. Petals probably yellow. Standard 15–17 mm long, elliptic, 6–7 mm wide, emarginate at the apex, with a very short, indistinct claw. Wings 15 mm long; blades narrowly oblong, at the apex deeply incised, 7 × 2 mm; auricle 0.5 mm long, claw 8 mm long. Keel ca. 12 mm long; blades obliquely obovate, with rectangular-curved lower edge, and nearly straight upper edge, subacute at the apex, 5 × 2.5 mm; auricle acute, 0.3 mm long, claw 7 mm long. Stamen tube obliquely cut at the mouth. Ovary with a stipe ca. 2 mm long, linear, white hairy; style glabrous. Legumes unknown.

Astragalus sect. **Hemiphaca** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11(16): 20. 1868. TYPE: *Astragalus hemiphaca* Karelin & Kirilow.

Astragalus nigrodentatus N. Ulziykhutag ex Podlech & L. R. Xu, sp. nov. TYPE: China. Prov. Xizang: Distr. Kam, Dabo-Shan pass, 18 July 1893, *G. N. Potanin* (holotype, LE).

Differt ab *A. alaschano* indumento e pilis 0.6–0.8(–1) mm (nec 0.1–0.3 mm) longis consistente, stipulis 6–7 (nec 2–3) mm longis, foliolis anguste ovatis ad anguste ellipticis, 5–14 × 2.5–5 mm (nec ellipticis ad obovatis, 3–7 × 2–5 mm), bracteis 4–6 mm (nec 0.8–1 mm) longis, calyce ca. 5 mm (nec 2.5–3 mm) longis.

Plants 8–10 cm tall, covered in vegetative parts with flattened, long-acuminate white hairs widest near the base and elsewhere with slender black hairs mixed in. Stems ascending, at the base pale, stolon-like, glabrous, with few, remote leafless stipules, in upper part sulcate, loosely to rather densely covered with stiff, tangled, ascending to spreading white, toward the nodes mostly black hairs 0.6–0.8 mm long. Stipules greenish, 6–7 mm long, narrowly triangular to triangular, free from the petiole, those without developed leaves connate up to the middle, the other ones free from each other, the lower ones glabrous, the upper ones loosely or, especially toward the margins and tip, densely white and partly also black hairy. Leaves 3–5 cm long; petiole 0.8–1.5 cm long, distinctly grooved on the upper side, similar to the rachis loosely white hairy like the stem. Leaflets in 6 to 8 pairs, narrowly ovate to narrowly elliptic, 5–14 × 2.5–5 mm, obtuse at the apex, on upper side glabrous but with densely white hairy margins, on underside loosely covered with appressed hairs 0.2–0.5 mm long. Peduncles 1.5–3.5 cm long, sulcate, loosely to densely covered with subappressed black hairs 0.3–1 mm long, at the base with some white hairs mixed in. Racemes short, densely many-flowered. Bracts whitish membranous, narrowly triangular, 4–6 mm long, with predominantly black hairs, at the base with sessile, minute glands. Flowers subsessile. Calyx ca. 5 mm long, campanulate, densely covered with ascending to partly nearly spreading black hairs 0.3–0.6 mm long; teeth very narrowly triangular, ca. 2 mm long, hairy on inner side. Petals probably violet in life, pale yellowish brown when dry. Standard ca. 9 mm long; blade ca. 4 mm wide, oblong, at the apex widely and deeply incised, at the base cuneately narrowed without distinct claw. Wings ca. 7.5 mm long; blades obtriangular, widest at the widely and deeply incised apex, 4.5 × 2 mm; auricle 0.3–0.4 mm long, claw 3 mm long, curved. Keel 6.5 mm long; blades oblique-elliptic, with widely curved lower edge and straight upper edge, subacute at the apex, 3.5 × 2 mm; auricle ca. 0.3 mm long, acute, claw ca. 3 mm long. Stamen tube truncate at the mouth. Ovary subsessile, minute, elliptic, glabrous, 2-ovulate. Legumes unknown.

Astragalus nigrodentatus differs from *A. alaschanus* Bunge by the hairs 0.6–0.8(–1) (vs. 0.1–0.3) mm long, stipules 6–7 (vs. 2–3) mm long, leaflets narrowly ovate to narrowly elliptic, 5–14 × 2.5–5 mm (vs. elliptic to obovate, 3–7 × 2–5 mm), bracts 4–6 (vs. 0.8–1) mm long, calyx ca. 5 (vs. 2.5–3) mm long.

This collection was named *Astragalus nigrodentatus* by Ulziykhutag in the herbarium at St. Petersburg (LE) without description.

Astragalus sect. **Laguropsis** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11(16): 137. 1868. TYPE: *Astragalus laguroides* Pallas (lectotype, designated by Podlech (1990: 479)).

Astragalus novissimus Podlech & L. R. Xu, nom. et stat. nov. Based on *Astragalus laguroides* Pallas var. *micranthus* S. B. Ho, Bull. Bot. Res. North-East. Forest. Inst. 3(4): 57. 1983 "non *A. micranthus* Desv., 1814." TYPE: [China.] Nei Mongol, Baganmaotasum (patria ignota), 29 May 1931, *T. N. Liou 2147* (holotype, WUK). Figure: Ho (1983: 66, fig. 5; as *A. laguroides* var. *micranthus*).

Because of the short original diagnosis of this taxon a complete description is given here.

Plants 8–12 cm tall, acaulescent, with merely white, in vegetative parts distinctly warty, hairs. Caudex slender, simple or with a pluricipital root-crown. Stipules whitish, 3–4 mm long, triangular, nearly free from the petiole, appressed hairy, at the margins with basifixed hairs. Leaves 3–6 cm long; petiole 1–3 cm long, like the rachis slender, loosely to rather densely covered with medifixed, appressed hairs 0.5–1 mm long. Leaflets in 2 to 4 pairs, in the basal leaves often only in 1 or 2 pairs, narrowly elliptic to elliptic, 7–12 × 3–5 mm, acute at the apex, on both sides rather densely to densely covered with medifixed, appressed hairs 1.5–2(–3) mm long. Peduncles 3.5–6 cm long, slightly angular-sulcate, loosely to rather densely covered with medifixed, appressed hairs 0.5–1 mm long, partly glabrescent with age. Racemes ovoid, 3–5 cm long, densely many-flowered. Bracts whitish, ca. 2 mm long, narrowly triangular, covered with mostly basifixed hairs. Flowers subsessile. Calyx 11–12 mm long, tubular at beginning of anthesis, soon ovoid-inflated, rather densely covered with subbasifixed to basifixed, rigid, spreading, straight white hairs 2–3 mm long; teeth subulate, 3–4 mm long. Standard ca. 14 mm long; blade ca. 5 mm wide, elliptic, narrowly triangular toward the slightly emarginate apex, slightly constricted below the middle, at the base obtusely angularly passing into the claw. Wings 13 mm long; blades narrowly oblong, round-tipped, ca. 5 × 1.5 mm; auricle 0.5 mm long, claw 8 mm long. Keel 12 mm long; blades obliquely obovate, with rectangular-curved lower edge and nearly straight upper edge, acute-tipped, 3.5 × 1.5 mm; auricle acute, 0.5 mm long, claw ca. 8 mm long. Stamen tube truncate at the mouth. Ovary sessile, hairy. Legumes unknown.

Astragalus sect. **Polycladus** Y. C. Ho, Bull. Bot. Res. North-East. Forest. Inst. 1(3): 107. 1981. TYPE: *Astragalus polycladus* Bureau & Franchet.

The following species was proposed as a new species in *Sendtnera* 7: 198. 2001, but unfortunately without a Latin diagnosis.

Astragalus tibeticola Podlech & L. R. Xu, sp. nov. TYPE: China. Prov. Xizang: S Tibet, Chayul Dzong, Loro Chu, 23 Apr. 1936, *F. Ludlow & G. Sherriff 1326* (holotype, BM).

Differt ab *A. monbeigii* caulibus pilis 0.4–0.7 mm (nec 0.1–0.3 mm) longis obtectis, calyce 4–5 mm longo dentibus ejus 1.5–2 mm longis (nec 5–6 mm longo dentibus ejus 2.5–4 mm longis), vexillo ca. 6 mm longo et 5 mm lato, lamina transverse elliptica (nec ca. 10.5 mm longo, lamina late obovate), ovario sessile (nec stipite 1.5–2 mm longo suffulto).

Plants 15–25 cm tall. Stems 10–17 cm long, branched at the base, ascending to erect, striate-sulcate, sparsely to loosely covered with appressed to subappressed white, at the nodes also black, hairs 0.4–0.7 mm long. Stipules green, 6–9 mm long, ovate-acuminate to narrowly triangular, free from the petiole, behind the stem high up vaginate-connate, sparsely to loosely covered with appressed white and sometimes also with some black hairs. Leaves 6–12 cm long; petiole 1–3 cm long, like the rachis loosely covered with appressed white hairs 0.2–0.5 mm long. Leaflets in 9 to 11 pairs, narrowly elliptic to elliptic, 7–17 × 3–6 mm, rounded to slightly emarginate at the apex, on upper side glabrous, on underside sparsely and mainly at the midrib furnished with appressed white hairs 0.5–1 mm long. Peduncles 5–6 cm long, hairy like the stem but in upper part with predominantly black hairs. Racemes ovoid, rather loosely 7- to 15-flowered. Bracts whitish, linear-acute, 2.5–3 mm long, predominantly black hairy. Pedicels ca. 1 mm long, black hairy. Calyx campanulate, 4–5 mm long, slightly oblique at the base, slightly obliquely cut at the mouth, rather densely covered with appressed black hairs 0.2–0.3 mm long and with fewer, slightly longer white hairs; teeth subulate, 1.5–2 mm long. Petals mauve with whitish center, keel purplish mauve. Standard ca. 6 mm long; blade 5 mm wide, transverse-elliptic, deeply incised at the apex, at the base subabruptly contracted into the very short claw. Wings ca. 6 mm long; blades oblong, rounded at the apex, 3.5 × 2 mm; auricle wide, ca. 0.5 mm long, claw 2.5 mm long. Keel 5 mm long; blades oblique-elliptic, rounded at the apex, 3 × 2 mm; claw 2 mm long. Stamen tube truncate at the mouth. Ovary sessile, white-hairy; style glabrous. Legumes unknown.

Astragalus tibeticola differs from *A. monbeigii* N. D. Simpson by stems covered with hairs 0.4–0.7 (vs. 0.1–0.3) mm long, calyx 4–5 mm long with teeth 1.5–2 mm long (vs. 5–6 mm long with teeth 2.5–4 mm long), standard ca. 6 × 5 mm, the limb transversely elliptic (vs. ca. 10.5 mm long, the limb widely obovate), ovaries sessile (vs. with a stipe 1.5–2 mm long).

Astragalus sect. **Skythropos** N. D. Simpson, Notes Roy. Bot. Gard. Edinburgh 8: 255. 1915. TYPE: *Astragalus skythropos* Bunge (lectotype, designated by Podlech (1990: 488)).

Astragalus griersonii Podlech, sp. nov. TYPE: Bhutan, Me La, 27°58′N, 91°37′E, 14,000 ft., 7 Aug. 1933, *F. Ludlow & G. Sherriff 429* (holotype, BM).

Differt ab *A. kongrensi* plantis 20–25 (nec 6–14) cm altis, in partibus vegetativis pilis praecipue nigris (nec mere albis) obtectis, calyce ca. 8 (nec 9–12.5) mm longo, campanulati-tubuloso (nec tubuloso), dentibus 3–4 (nec 4–7) mm longis, petalis brevioribus.

Plants 20–25 cm tall, with subappressed to ± spreading, thin, long white and black hairs. Caudex with rather long stolons up to 10 cm long, furnished with leafless, pale, scale-like stipules. Stems erect, short, terete to angular-sulcate, loosely to rather densely covered with subappressed to mostly ± spreading, predominantly black hairs 0.3–1 mm long. Stipules 8–12 mm long, dirty whitish to slightly greenish, ovate-acuminate, free from the petiole and from each other, sparsely to loosely covered with tangled, subappressed to ascending white and black hairs, sometimes subglabrous. Leaves 9–16 cm long; petiole 3–5 cm long, like the rachis sulcate, black hairy like the stem. Leaflets in 9 to 11 pairs, elliptic to nearly orbicular, 5–12 × 4–9 mm, emarginate at the apex, on upper side sparsely, on underside loosely covered with subappressed white or white and black hairs 0.5–1 mm long. Peduncle 10–12 cm long, in lower part distinctly, in upper part slightly angular-sulcate, rather densely covered with ascending to spreading blackish hairs 0.5–1.5 mm long. Racemes short, often globose, ca. 3 cm long, rather densely 9- to 12-flowered; axis black villous. Bracts whitish, narrowly oblong to narrowly elliptic, 5–6 mm long, 1–1.5 mm wide, on outer side rather densely covered with tangled black hairs up to 1.5 mm long, on inner side (upper side) sparsely hairy. Pedicels 1.5–2 mm long, very densely black hairy. Bracteoles absent. Calyx ca. 8 mm long, campanulate-tubular, truncate at the mouth, rather densely to densely covered with subappressed to ascending black hairs 0.3–1 mm long; teeth narrowly triangular, 3–4 mm long, sparsely hairy on inner side. Petals purple to bluish white. Standard ca. 16 mm long; blade ca. 7 mm wide, widely rectangular, distinctly emarginate at the wide apex, at the base with a cuneate claw of equal length. Wings ca. 15 mm long; blades narrowly oblong, rounded at the apex, 8 × 3 mm; auricle narrow, 2.5–3 mm long, claw ca. 7 mm long. Keel ca. 16 mm long; blades oblique-obovate, with lower edge rectangularly curved in distal part and upper edge nearly straight, subobtuse at the apex, ca. 8.5 × 4 mm; auricle ca. 1 mm long, claw ca. 8 mm long. Staminal tube ± truncate at the mouth. Ovary with a stipe ca. 4 mm long, densely covered with subappressed white and predominantly black hairs ca. 1 mm long; style thickish, hairy in lower half. Legumes unknown.

Astragalus griersonii differs from *A. kongrensis* Baker by being 20–25 (vs. 6–14) cm tall, in vegetative parts with predominantly black (vs. merely white) hairs, calyx ca. 8 (vs. 9–12.5) mm long, with teeth 3–4 (vs. 4–7) mm long, standard ca. 16 (vs. 16–21) mm long.

Astragalus sect. **Trachycercis** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11(16): 114. 1868. TYPE: *Astragalus humilis* M. Bieberstein (lectotype, designated by Podlech (1990: 490)).

Astragalus lang-ranii Podlech, nom. et stat. nov. Based on *Astragalus salsugineus* Karelin & Kirilow var. *multijugus* S. B. Ho, Bull. Bot. Res. North-East. Forest. Inst. 3(1): 52. 1983, non *Astragalus multijugus* DC. TYPE: [China.] Ningxia: Yinchuan, prope viam ferream, 1200 m, 14 May 1959, *Y. C. Ho 2135* (holotype, WUK; isotype, PE).

Because of the short original diagnosis of this taxon a complete description is given here.

Astragalus lang-ranii is near to *A. alaschanensis* H. C. Fu, but differs by smaller leaflets (3–4 × 1.3 mm vs. 5–15 × 3–7 mm), shorter bracts (4–6 mm vs. 10–15 mm long), shorter calyx (12–13 mm vs. 15–18 mm long; teeth 2.5–4 mm vs. 5–9 mm long).

Plants ca. 10 cm tall, shortly caulescent, densely covered with symmetrically to asymmetrically bifurcate, spreading white hairs, the branches up to 1 mm long. Caudex slender, simple or shortly branched. Stems up to 5 cm long, densely tomentose. Stipules whitish, adnate to the petiole for 2–4 mm, the lower triangular, 3–4 mm long, the upper narrowly triangular-acuminate 5–7 mm long, all densely hairy. Leaves 8–12 cm long; petiole 3–4 cm long, like the rachis slender, flexuous or curved, rather densely hairy. Leaflets in 11 to 13 pairs, elliptic, 3–6 × 1.5–3 mm, rounded to acute at the apex, on both sides covered with tangled, ± spreading hairs. Peduncles 1–1.5 cm long, hairy like the stem. Raceme loosely 4- to 6-flowered. Bracts whitish, 4–6 mm long, ovate-acuminate, loosely white-hairy, partly with basifixed hairs. Pedicels 2–3 mm long, hairy. Calyx 12–13 mm long, tubular, obliquely truncate at the mouth, densely covered with short to long spreading, tangled hairs; teeth subulate, 2.5–4 mm long. Petals pale purple. Standard 20–22 mm long; blade ca. 7 mm wide, narrowly ovate, ± rounded at the apex, very shortly

narrowed at the base. Wings ca. 19 mm long; blades narrowly obovate, obliquely slightly incised at the apex, 10 × 3 mm; auricle 1 mm long, claw 9 mm long. Keel 15 mm long; blades obliquely elliptic-triangular, with widely curved lower edge and nearly straight upper edge, obtuse at the apex, 6 × 3 mm; auricle short, claw 9 mm long.

Etymology. Named after Prof. Xu Lang-Ran, co-worker on the *Flora of China*, who has recognized the distinctness of this species. The hyphen in the Latin name *lang-ranii* must be retained because two forenames are combined.

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A New Species of *Ledermanniella* (Podostemaceae) from Cameroon

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ABSTRACT. *Ledermanniella prasina* J. Schenk & D. W. Thomas in the family Podostemaceae, subgenus *Ledermanniella*, is proposed as a new species. It is known only from its type, collected at a single waterfall in Cameroon. The ecology, morphology, and variation among individuals are discussed. The new species is compared to the morphologically similar *L. bifurcata*, *L. bowlingii*, *L. guineensis*, *L. jaegeri*, *L. minutissima*, and *L. monandra*. Illustrations and a key to the monostaminate species in the subgenus are provided.

Key words: aquatic plants, Cameroon, *Ledermanniella*, narrow endemic, Podostemaceae.

With its center of diversity in Cameroon, *Ledermanniella* Engler is the second largest genus in Podostemaceae, consisting of about 44 species, which are all endemic to tropical Africa (Cook, 1996; Cusset, 1983, 1984). As defined by Cusset (1974), *Ledermanniella* is distinguished from other genera in the family through the combination of the following characters: the presence of alternate or whorled leaves, solitary or occasionally clustered flowers inverted within a closed spathellum, and an ovoid to ellipsoidal capsule with eight ribs. This broader classification ignored pollen and stamen number traits previously used and resulted in the inclusion of *Inversodicraeia* Engler and *Monandriella* Engler within *Ledermanniella* (Cusset, 1974). Subsequently, Cusset divided the genus into two subgenera, *Phyllosoma* and *Ledermanniella*, distinguished by the presence or absence of scale-like leaves, respectively (Cusset, 1983, 1984).

The new taxon is clearly a member of Podostemaceae due to its semi-aquatic habitat, thallus-like base (root), the presence of spathella, flowers that consist of two tepals, a syncarpous superior gynoecium with two styles, a single anther, and capsular fruit. The new taxon is placed in *Ledermanniella* based on its alternate leaves, solitary to clustered flowers each inverted within a closed spathellum, two filamentous tepals, flowers borne along shoots above a thalloid-root, and ellipsoidal capsules. It is placed in the subgenus *Ledermanniella* based on the absence of scale-like leaves and the presence of elongated leaves. The new species is known only from the type collection, which consists of approximately six pressed individuals along with 25 stems and shoots (which were separated from each other and/or other individuals at the time of collection), and two individuals along with 13 stems and shoots preserved in alcohol. Both collections have buds, flowers, and fruits in all stages of development.

TAXONOMY

Ledermanniella prasina J. Schenk & D. W. Thomas, sp. nov. TYPE: Cameroon. Southwest Province: 14 km NE of Mundemba, base of a large waterfall in the Mana River, between the villages of Miangwe 2 and Meta, 300 m, 5°02.4′N, 9°01.0′E, 01 Dec. 1998, *Duncan Thomas 11550* (holotype, MO; isotypes, K, LBV, MO (preserved), NY, OSC, P, SCA, WAG, YA). Figure 1.

Speciebus monostaminiferis subgeneris *Ledermanniellae* similis sed distinguibilis seminibus smaragdinis et floribus (tepalis anthera gynoecioque includentibus) majoribus.

Semi-aquatic herbs from the spray-zone of a waterfall; thalloid-root disk-shaped, holdfast attaching plant to rock substratum; plants erect, 9–13 cm tall; main stem arising from thalloid-root, 1.0–32.0 mm long, 1.0–2.0 mm wide, erect; vegetative shoots arising from main stems, filiform, dichotomously branched, up to 7 cm long; fertile shoots arising from main stem, filiform, dichotomously branched, bearing reproductive structures; leaves up to 4 cm

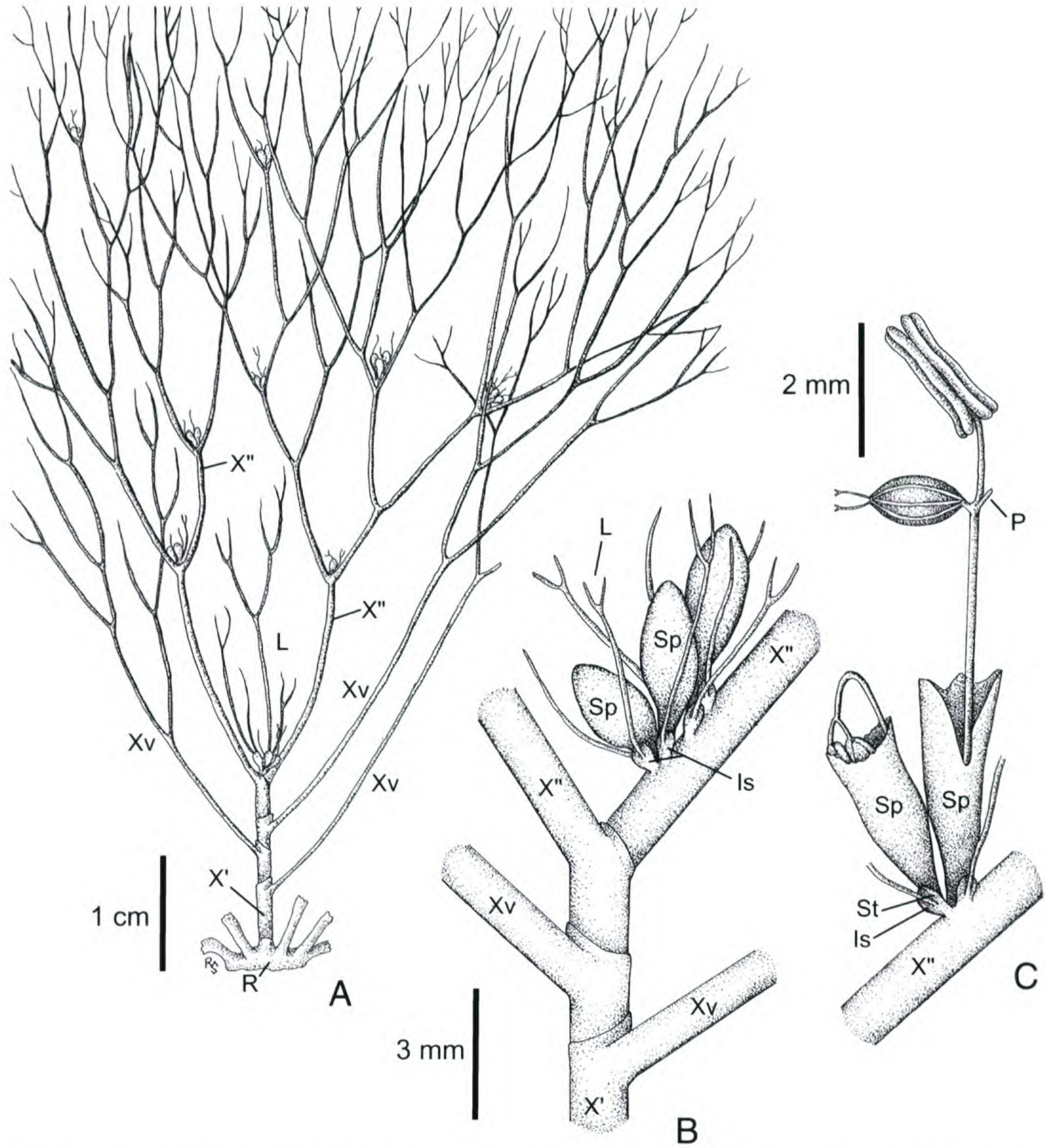

Figure 1. *Ledermanniella prasina* J. Schenk & D. W. Thomas, based on *D. W. Thomas 11550.* —A. Detailed habit of a single main stem showing the structure of the main stem (X′), fertile shoots (X″), vegetative shoots (Xv), leaves (L), and a thalloid-root (R; note that the apical portion and other mains stems are omitted for clarity). —B. A segment of the primary and fertile shoots showing the details of a flowering cluster, unruptured spathella (Sp) with leaves subtending spathella; also seen are stipules (St) located on the intrapetiolar scales (Is). —C. Ruptured spathella, with emerging, inverted flower (left) and fully emerged flower (right), along with tepals (P; only one of two shown).

long, 0.1–0.5 mm wide, dichotomously branched, solitary to verticillate below spathella, basal portion scale (intrapetiolar scale) with stipules, apical portion elongating from center of scale, filiform, glabrous; spathella erect, 3.0–8.0 mm long before dehiscence, 1.0–2.2 mm wide, ovate at beginning of development, then elongating to clavate, glabrous, solitary or in clusters (1–6) in the axils or along fertile shoots, apex globose to acute, dehiscence mostly irregular, occasionally bilobed to trilobed; flowers solitary within spathella, zygomorphic, inverted prior to the opening of the spathella, upright after elongation, pedicel up to 13 mm long, tepals 2, acicular, 0.4–0.7 mm long, gynoecia 1.5(–1.7) mm long, 0.7–0.9 mm wide, attached to a gynophore, unilocular, styles 2, linear, 0.6–0.8 mm long, stigmas bilobed; stamens 1 (very rarely 2); filaments (= andropodium) 1.1–1.3 mm long at spa-

thellum dehiscence, 5.0–5.3 mm long after anthesis, alternate to the tepals; anthers basifixed, 2.0 mm long, 0.5–0.8 mm wide, longitudinally dehiscent; pollen white, in monads; capsules elliptic, 2.2–2.7(–3) mm long, 1.0–1.2 mm wide, bivalved, one valve persistent after dehiscence, the other caducous, ribs 8 per capsule, with 3 ribs per valve and 2 as the marginal sutures; placentas green; seeds bright emerald green, 0.3–0.4 mm long, 0.125–0.15 mm wide, ca. 25 to 37 per capsule.

Ecology

Like many Podostemaceae, species of the genus *Ledermanniella* are sometimes narrowly endemic to a single geographical area (Cook, 1996). From our current knowledge, *L. prasina* occurs only at a single site, and is therefore narrowly endemic to the Mana River valley in the Rumpi Hills of Cameroon. On the basis of this information, it should be reddata listed as an endangered species according to the criteria established by the International Union for the Conservation of Nature (IUCN). The new species occupies a very unusual and specific habitat. The waterfall in the Mana River consists of two stages with a total height of approximately 100 m. At the bottom, there is a large, deep pool and a shelf of exposed gneiss bedrock, about 200 m^2 in extent; *L. prasina* occurs only on this shelf. The shelf is above the observed high-water level in the river, but its largely unvegetated state suggests periodic scouring, probably during occasional flash floods. The area has a very wet but strongly two-seasonal climate with a total annual rainfall exceeding 5000 mm. There is a short dry season December to March, with three months averaging less than 100 mm of rain. The first part of the wet season is typified by thunderstorms of varying frequency and duration, sometimes with dry periods of several weeks' duration. The wet season peaks in August and September, when monthly rainfall may exceed 1000 mm (Chuyong et al., 2004). This wet, seasonal climate, combined with the rugged, rocky topography of the Rumpi Hills, generates the type of river that is ideal for Podostemaceae, with a rocky bed and large seasonal variation in flow. With the exception of *L. prasina*, all Podostemaceae reported from Cameroon follow similar phenological patterns in response to this climate. The plants are obligate hydrophytes and grow submerged in fast-flowing water during the wet season, attached to the rocks by thalloid-roots. When the water level in the rivers subsides at the beginning of the dry season, the exposed plants flower and fruit rapidly, after which at least the aerial parts die (Cusset, 1987; Thomas, pers. obs.). Several species of Podostemaceae exhibiting this phenology have been collected from the Mana River, including *Ledermanniella ledermannii* (Engler) C. Cusset, *Macropodiella pellucida* (Engler) C. Cusset, and *Saxicolella flabellata* (G. Taylor) C. Cusset (Cusset, 1987).

Ledermanniella prasina exhibits a very different habit and phenology, which is unique for the family in Cameroon. It does not grow submerged as most podostemads do, but instead has erect aerial stems and shoots that are kept moist throughout the growing period by spray generated from the waterfall. The spray is continuous during the wetter months with high water flow in the river, and it is this spray that supports the growth of the new species. The aerial shoots are intolerant of desiccation and wither rapidly when removed from the moist environment. In the dry season, the waterfall is present but much reduced in volume, and little spray reaches the rock shelf that supports the *L. prasina* population. During this period, the dry rocks appear to be largely devoid of vegetation and we do not yet know if *L. prasina* is annual, or if it passes the dry season as a dormant thalloid-root. Instead of having the short flowering period typical of Podostemaceae when the water level drops, the flowering and fruiting of *L. prasina* are prolonged and take place during the latter part of the growing season, when its fertile branches are produced. During this same period, the other Podostemaceae in the river are submerged and growing vegetatively, but they do not flower.

For several reasons, we do not believe that *Ledermanniella prasina* is a terrestrial form of one of the many other Podostemaceae that grow in the area. No other species of subgenus *Ledermanniella* have been collected from the Mana River. In addition, the *L. prasina* population is limited to a rock shelf, at least a meter above the high-water level, and does not extend down to the water, suggesting that it is intolerant of extended periods of submersion. Finally, some of the traits that separate the new species from similar species are structural or reproductive, and likely to be independent of habitat-related morphological plasticity.

Morphology

Podostemads are difficult to describe in terms of standard angiosperm morphology due to their greatly reduced vegetative anatomy and unusual morphology. Distinguishing vegetative organs using cell and tissue orientation is an extremely difficult if not an impossible task (Rutishauser, 1995; Ameka et

al., 2003). The literature contains descriptive inconsistencies among the interpreted structures, demonstrating a general discordance of terminology and homology assessment among biologists studying Podostemaceae (Rutishauser, 1995; Sehgal et al., 2002). We use the terms "root," "main stems," "fertile shoots," "vegetative shoots," and "leaves" (Fig. 1) simply to describe this species; however, homology of such organs remains uncertain (Rutishauser, 1995, 1997).

The root structure is represented by an undefined thalloid tissue with a holdfast (= hapteron) located underneath. The function of the holdfast is to stabilize the plant by attaching it to the substrate. Botanists working with Podostemaceae use the term holdfast or hapteron, borrowed from algae terminology, to describe the superficially similar structure (Taylor, 1954; Hammond, 1937; Philbrick, 1984). The shape of the thalloid-root is described as being disk-like. However, the variability in thalloid-root shape is not fully understood in this species. The term "thalloid-root" is used to describe the undifferentiated tissue of which the main stem arises and that binds the plant to the substrate. There is no implication of homology to the familiar idea of a root since the structure has been suggested to be derived from a stem, a coalesced stem and root, or simply a modified root (Sehgal et al., 2002; Rutishauser, 1995). This term conforms to current literature and the root-shoot (CRS) model as the structure located underneath the main stem. However, much anatomical work needs to done on this plant as well as other podostemads before more concise determinations of homology can be made.

Approximately four to five main stems develop directly from the thalloid-root for each individual (Fig. 1A). The vegetative shoots and fertile shoots are borne on the main stem. The majority of the flowers are borne on the fertile shoots; however, some parts of the thalloid-root contain a shorter main stem of which there are no apparent vegetative or fertile shoots, but do have spathella subtended by leaves. It is not known if these stems elongate later in development and give rise to the vegetative and fertile shoots or remain as shorter dimorphic stems. This trait is not found in all individuals.

Two types of shoots are borne from the main stem, fertile shoots and vegetative shoots. The vegetative shoots branch dichotomously and appear leaf-like. There are two to three vegetative shoots borne on the main stem, before the fertile shoots arise (Fig. 1A). Located where the vegetative shoots diverge from the main stem, ligule-like structures are found that encircle it (Fig. 1A, B). The fertile shoots tend to be thicker than the vegetative shoots where they are borne on the main stem (Fig. 1A, B). They also differ by having reproductive structures along the branches and in the axils of dichotomous branches (Fig. 1A, B).

Leaves are located below the spathella (Fig. 1A–C). The basal portions of the leaves are scale-like, with an elongating thread-like leaf that dichotomously branches, similar in appearance to the vegetative stems. Stipules are located along the side of the scale. Ameka et al. (2003) referred to the basal scale as an intrapetiolar scale, which can also be rudimentary lateral stipules. We apply the term "leaves" to remain consistent with literature describing similar species (Ameka et al., 2003; Rutishauser, 1997; Hall, 1971; Taylor, 1954).

The spathella are quite variable in this species. The shape can vary from ovate to elliptic to clavate as they mature. It is also found that the spathella on the distal parts of the shoots are more ovate than those located toward the base. There is further variation in the spathellum margin following dehiscence. Most spathella have irregular margins following dehiscence; some, however, develop bilobed or trilobed margins.

The number of stamens is a variable character in this taxon as well as in other select species of Podostemaceae (Cusset, 1974). Two out of approximately 75 shoots have a single flower (each individual has approximately four to five shoots with an average of ca. 20 flowers per shoot) that contains two anthers attached to an andropodium (specimen housed at OSC). However, variability in anther number is rare enough that we continue to describe this species as monostaminate. Furthermore, a single individual was found containing two ovaries attached to a single gynophore (specimen housed at OSC). From our understanding of the group, this is a novel attribute for *Ledermanniella*. We could not find any literature documenting this mutation, suggesting its anomaly, and we therefore did not include it in the description.

The specific epithet "prasina" refers to the emerald green seeds that were removed from dehisced capsules. Less mature seeds seen inside undehisced capsules are also green.

Detailed comparisons were made between the new species and similar described species. The species selected for comparison included all monostaminate species from the subgenus, plus one species with two stamens. Published descriptions were used for the comparisons in all but two cases, where we needed to examine herbarium material.

Comparisons were made using herbarium material with the two monostaminate species, *Leder-*

manniella bowlingii (J. B. Hall) C. Cusset from Ghana and *L. guineensis* C. Cusset from Guinea. These two species were examined because they resemble the general habit of *L. prasina*: a single stamen, elongated shoots, intrapetiolar scale (*L. bowlingii* only), and linear leaf or leaf-like structures.

The herbarium material along with written descriptions demonstrate that *Ledermanniella bowlingii* differs qualitatively by having papillate spathella, pollen in dyads, inflorescence a cyme, and brown to reddish brown seeds, along with quantitative traits such as longer shoots, shorter tepals, smaller anthers, and smaller gynoecium (Hall, 1971; Cusset, 1984; Ameka et al., 2003). This was determined after examining the isotype (P) and a photograph of the holotype (K) along with descriptions and illustrations. *Ledermanniella guineensis* is distinguished from *L. prasina* by having a total length of one meter, inflorescence a cyme, a bilobed spathellum, the lack of leaves directly subtending the spathellum, smaller overall flower size, and brown to reddish brown seeds (Hall, 1971; Cusset, 1984). The holotype (P), along with four additional collections of *Ledermanniella guineensis*, was used for this comparison along with written descriptions and illustrations.

We did not use herbarium material to compare the three remaining monostaminate species *Ledermanniella jaegeri* C. Cusset, *L. minutissima* C. Cusset, both from Sierra Leone, and *L. monandra* C. Cusset from Cameroon, since the published descriptions of these species show they are very different. Both *L. minutissima* and *L. jaegeri* differ from *L. prasina* by containing leaves that subtend the spathella which lack intrapetiolar scales and dichotomous branching. *Ledermanniella minutissima* is further separated from *L. prasina* by possessing spathella that always arise from the thalloid or from a small shoot that is up to 3 mm long, and are always solitary (Cusset, 1984). *Ledermanniella jaegeri* has the additional character traits of leaves borne along the entire shoot instead of solely under the spathellum, as well as a more elliptic ovary (Cusset, 1984). *Ledermanniella monandra* appears to have an intrapetiolar scale; however, the leaves are borne on the entire length of the fertile shoot and are triangular in shape in contrast to the elongating leaves of *L. prasina* (Cusset, 1974, 1984).

The only bistaminate species investigated was *Ledermanniella bifurcata* (Engler) C. Cusset from Cameroon, Gabon, and Congo. Although it does have two stamens, it shares similar morphological traits, such as irregular spathella dehiscence, pollen in monads, and intrapetiolar scales, which are characters we felt needed further comparisons. Besides the anther number, *L. bifurcata* differs by having an ovate spathellum (*L. prasina* also has an ovate spathellum, though it elongates to become clavate as it matures), a fertile shoot that widens at nodes (vs. no widening at nodes in *L. prasina*), leaves subtending the spathellum for the entire length of the shoot, shorter tepal length, smaller closed spathella, longer spathella pedicels, smaller anther size, and smaller gynoecium (Cusset, 1984, 1987; Hall, 1971).

KEY TO THE MONOSTAMINATE SPECIES OF *LEDERMANNIELLA* SUBG. *LEDERMANNIELLA*

1a. Leaves present under spathella, intrapetiolar scale absent, leaves do not branch dichotomously.
  2a. Plants without elongated shoots (0–3 mm); leaves located only under spathella . . . . . *L. minutissima* C. Cusset
  2b. Shoots greater than 3 mm, leaves located along entire shoot . . . . . *L. jaegeri* C. Cusset
1b. Leaves either absent under spathella, or if present, with dichotomous branching and intrapetiolar scale.
  3a. Leaves triangular, 1–2 mm long . . . . . *L. monandra* C. Cusset
  3b. Leaves linear, greater than 2 mm long.
    4a. Spathella papillate, pollen in dyads . . . . . *L. bowlingii* (J. B. Hall) C. Cusset
    4b. Spathella glabrous, pollen in monads.
      5a. Stems up to 1 m long, trailing in moving water; leaves absent below spathella; spathella arranged in a cyme; spathella bilobed at dehiscence; anthers 1 mm long; tepals 0.3–0.4 mm long; seeds brown/red . . . . . *L. guineensis* C. Cusset
      5b. Plants 9–13 cm, erect on wet rock; leaves located below spathella; spathella solitary or in cluster; spathella irregular to bilobed at dehiscence; anthers 2 mm long; tepals 0.4–0.7 mm long; seeds emerald green . . . . . *L. prasina* J. Schenk & D. W. Thomas

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A New Species of *Minasia* (Asteraceae, Vernonieae) from the Planalto de Diamantina, Minas Gerais, Brazil

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ABSTRACT. A new species of *Minasia* (Asteraceae, Vernonieae) was found in the "campos rupestres" of the Planalto de Diamantina, Minas Gerais, Brazil. *Minasia lewinsohnii* is characterized by its overall small size, linear to elliptical subfleshy leaves, sessile to pedunculate capitula, and achenes with indumentum throughout the surface. So far, it is known from only one population.

Key words: Asteraceae, Brazil, *Minasia*, Vernonieae.

Minasia H. Robinson (Asteraceae, Vernonieae) was recently established by Robinson (1992), who created the genus based on two species previously described as belonging to *Vernonia* Schreber and established another new species. According to Robinson (1992, 1995, 1996, 1999), the genus currently includes five species: *M. alpestris* (Gardner) H. Robinson, *M. scapigera* H. Robinson, *M. pereirae* H. Robinson, *M. splettiae* H. Robinson, and *M. cabralensis* H. Robinson.

Minasia species are endemic to the campos rupestres of the Espinhaço Range in Minas Gerais, Brazil. More specifically, they occur in the high-altitude areas ranging from the Serra do Cipó to the Planalto de Diamantina, as well as in the isolated western extension of the campos rupestres in Minas Gerais, the Serra do Cabral. The campos rupestres have an immense diversity of species, many of which are endemic (Giulietti & Pirani, 1988). They are considered to present the greatest degree of endemism among Brazilian vegetation types (Joly, 1970). Therefore, finding a new species in these environments is not surprising.

Recent collecting trips were conducted by faculty of the Universidade Estadual de Campinas for taxonomic, genetic, and ecological studies on the interactions between Asteraceae and phytophagous insects. During those trips, a new, seemingly micro-endemic species of *Minasia* was found in the Planalto de Diamantina. This region seems to be the one with the greatest diversity of *Minasia* species, with four of the five previously described species occurring there (*M. alpestris*, *M. scapigera*, *M. pereirae*, and *M. splettiae*), in addition to the new species proposed here.

Minasia lewinsohnii J. Semir & F. F. Jesus, sp. nov. TYPE: Brazil. Minas Gerais: Diamantina, Estrada Guinda–São João da Chapada, campo arenoso com cascalho quartzítico, 18°09.59′S, 43°43.00′W, 7 Sep. 1996 (fl, fr), *T. M. Lewinsohn, P. I. Prado, A. J. Santos & J. C. Silva in PIC96696* (holotype, UEC; isotypes, K, MO, R, SPF, UEC, US). Figure 1.

Haec species *Minasiae cabralensi* capitulis interdum pedunculatis similis, sed ab ea habitu breviore, laminis foliorum minoribus carnosisque, pedunculis brevioribus et achenia omnino indumento obtecta differt. Habitu *M. splettiae* appropinquat.

Plant 19–41 cm tall, herbaceous, perennial; stem 1–6 cm tall, obscured by the surrounding leaf sheaths. Leaves forming rosettes, sessile, sheaths ca. 3 mm tall, blades 2–9 × 0.2–0.8 cm, subfleshy, linear to elliptic, apex acute, margin entire; venation pinnate, ascending nerves inconspicuous. Inflorescence scapose, scape 13.5–40 cm tall, 1.7–2.9 mm diam., partially leafy, up to 3 per rosette, few or no branchings at the apical region, 1 to 5 capitula per branch; leaves of the scape sessile, 9.3–26 × 1.8–5.8 mm, ovate-elliptic, apex acute, base enlarged, margin entire. Capitula sessile to pedunculate, peduncles 0.5–1.5 cm long; involucre of the capitulum 7.7–13.7 mm tall, 5.7–13.4 mm wide, with ca. 6 to 8 series of phyllaries; phyllaries 2–6.5 × 1.2–2.3 mm, the most external ovate, the most internal linear, apex acute to acuminate, distally villous as well as on the more lateral portions of the abaxial face, glabrous on the proximal region

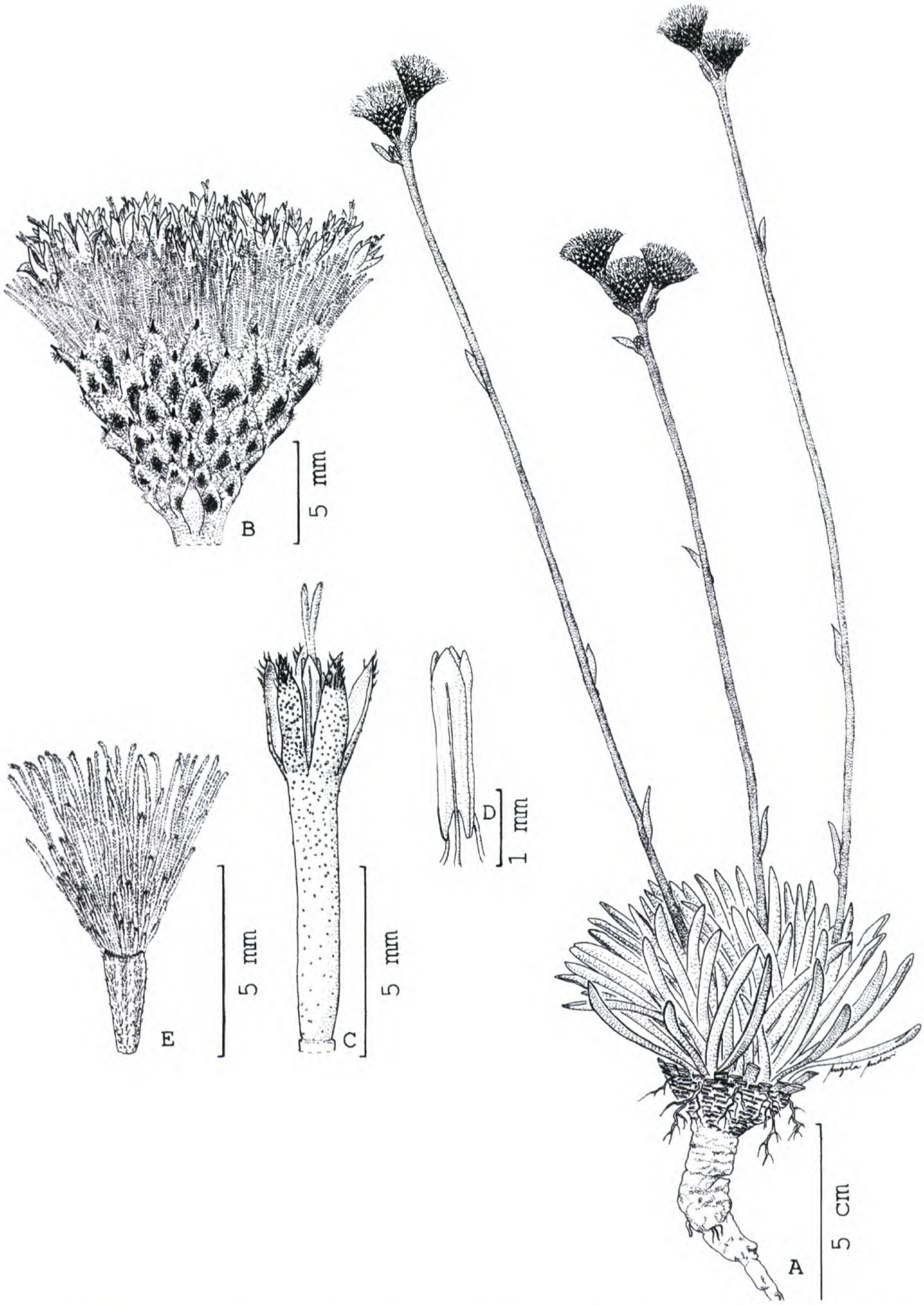

Figure 1. *Minasia lewinsohnii* J. Semir & F. F. Jesus. —A. Habit. —B. Capitulum. —C. Flower. —D. Anthers. —E. Achene with pappus. Drawn from the holotype, *PIC96696* (UEC).

of the adaxial face, margin barbellate, purple on the middle, pale on the margins. Flowers 21 to 43 per capitulum; corolla 7.1–10.6 mm long, lavender to magenta, densely glandular-verrucous on the lobes, sparsely so on the tube, tomentose on the external apex of the lobes, glabrous below; lobes 2.5–3.2 × 0.6–0.8 mm, lanceolate; anthers 2.9–4.2 mm long, tails ca. 0.7 mm long, apical appendages

0.6–1.0 × 0.2–0.3 mm, triangular to sub-lanceolate, apex acute; style ca. 12 mm long. Achene 2.2–3.5 mm long, 0.8–1.5 mm diam., ribbed, ca. 8 ribs, sericeous to setuliferous indumentum, dense to sub-glabrescent throughout the surface, sometimes denser at the base, glandular surface; pappus bristles 0.4–7.5 mm tall, in indistinguishable series, the most external ones gradually shorter, lavender to magenta, barbellate.

The species is comparable in general size—both of rosette and inflorescence—to *Minasia pereirae* and *M. splettiae*. In inflorescence height it is also comparable to *M. cabralensis*; however, the rosette leaves are shorter in *M. lewinsohnii* (up to 9 cm long) than in *M. cabralensis* (10–16 cm long), giving *M. lewinsohnii* the appearance of an overall smaller plant. *Minasia lewinsohnii* is much smaller than *M. alpestris* and *M. scapigera*, both of which can be up to 1 m tall. In addition to the difference in general size, the leaves in *M. lewinsohnii* are linear to elliptical, not oblanceolate as in *M. alpestris*, and the inflorescence is not congested like the one in *M. scapigera*.

The capitula in this new species may be pedunculate, as they generally are in *Minasia cabralensis*, but very rarely in the other species of the genus. However, the peduncles are much shorter in *M. lewinsohnii* than in *M. cabralensis* (up to 1.5 cm vs. up to 35 cm long). Also, the achene in *M. lewinsohnii* has indumentum throughout the surface, whereas in *M. cabralensis* the achene is distally glabrous (Robinson, 1996). Furthermore, the leaves are shorter and more fleshy in *M. lewinsohnii* than in *M. cabralensis*. To date, *M. cabralensis* seems to be restricted to the Serra do Cabral while *M. lewinsohnii* has been found only in the Planalto de Diamantina. *Minasia lewinsohnii* differs from *M. splettiae* in having wider and thicker leaves and from *M. pereirae* in having linear to elliptic rather than oblanceolate leaves.

To date, *Minasia lewinsohnii* is known only from one population, in the Planalto de Diamantina, occurring on sand. The species is named in honor of Thomas Lewinsohn (Departamento de Zoologia, Universidade Estadual de Campinas), one of the first collectors of this population.

Paratypes. BRAZIL. **Minas Gerais:** Diamantina, Estrada Guinda–S. João da Chapada, 18°09.58′S, 43°42.96′W, 23 June 2000 (fl, fr), *K. S. Yotoko et al. KSY-00/112* (BHCB, UEC), 29 Apr. 1997, *T. M. Lewinsohn et al. in PIC97032* (MBM, SP, UEC).

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Eugenia myrciariifolia (Myrtaceae), a New Species from Paraná, Brazil

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Abstract. *Eugenia myrciariifolia*, a new species from the southern Brazilian state of Paraná, is described and illustrated. This species is related to *Eugenia oeidocarpa*, from which it is set apart by the presence of cataphylls on the twigs, elliptic to lanceolate leaves, smaller or absent pedicels, and axillary, pilose flowers.

Resumo. *Eugenia myrciariifolia*, uma nova espécie do estado do Paraná, Brasil, é descrita e ilustrada. A nova espécie é próxima a *Eugenia oeidocarpa*, da qual se distingue pela presença de catáfilos nos ramos, folhas elípticas a lanceoladas, pedicelos menores ou ausentes e flores axilares e pilosas.

Key words: Brazil, *Eugenia*, Myrtaceae.

Eugenia L. is one of the largest genera of the Myrtaceae, with about 350 American species (Landrum & Kawasaki, 1997). The Brazilian species have remained largely unstudied since the paramount treatment of Berg (1857–1859), except for local floristic studies (e.g., Kiaerskou, 1893; Legrand & Klein, 1969; Kawasaki, 1989; Mattos, 1984; Barroso & Peron, 1994; Marchiori & Sobral, 1997; Sobral, 2003). While studying the family Myrtaceae in the state of Paraná, a small-leaved tree of the forests from the northern part of the state came to our attention and is here proposed as new.

Eugenia myrciariifolia Soares-Silva & Sobral, sp. nov. TYPE: Brazil. Paraná: Sapopema, Salto das Orquídeas, margem direita do rio Lageado, 8 Dec. 1995, *L. Soares-Silva 563* (holotype, UB; isotype, FUEL). Figure 1.

Species *E. oeidocarpae* proxima, a qua ramulis cataphyllorum instructa, foliis ellipticis vel lanceolatis (non obovatis), pedicellis usque 2 mm longis (non 2–5 mm longis) et floribus axillaribus ovariis pubescentibus recedit.

Small tree up to 5 m high; twigs red-brown or grayish, exfoliating, the younger ones somewhat angled, brown and puberulent with white trichomes 0.1–0.3 mm long, bearing at their bases spathulate to linear cataphylls 2.5–5.5 × 1 mm, these involute, with cilia to 0.1 mm. Leaves chartaceous, with scattered translucid punctations visible to the eye, these more evident abaxially, reticulate, slightly discolored, glabrous except for occasional scattered white trichomes to 0.1 mm long along the adaxial central nerve and 0.1–0.3 mm long at the base of leaves; blades elliptic to elliptic-lanceolate, 1–3 × 0.5–2 cm, the length/width ratio 2.2–2.8:1; apex obtuse to acute; base acute to attenuate; central nerve plane to slightly prominent adaxially and evidently raised abaxially; secondary nerves 6 to 10 pairs, evident on both faces and diverging at angles of 50°–75°; marginal vein 0.6–0.8 mm from margin, the margin itself with a yellowish ridge to 0.1 mm wide; petioles plane adaxially, 1–3 × 0.4–0.6 mm, with trichomes like those on the branches. Flowers axillary and solitary; pedicels 1–2 × 0.2–0.5 mm or absent; bracteoles persisting after anthesis, ovate to rounded ovate, 0.5–1 × 0.7–1.2 mm, ciliate; flower buds globose, 3–4 mm diam.; calyx lobes hemispherical, unequal in size, the external ones 1–1.3 × 1.5–2 mm, the internal ones 1.6–2 × 2–2.5 mm, sparsely puberulent without and sericeous within, with trichomes about 0.1 mm, the margins sometimes with red cilia to 0.4 mm; petals orbicular and concave, 2.5–3 mm diam., glabrous and ciliate; staminal ring sericeous, 1.5 mm diam.; stamens ca. 100, 4–5 mm, the anthers globose, 0.4–0.5 mm, with one apical gland; style glabrous, 4–6 mm; ovary externally pubescent or sericeous, about 1 mm long, bilocular, with 7 to 8 ovules per locule on a central placenta. Fruits not seen.

Habitat and distribution. *Eugenia myrciariifolia* is a small tree from seasonal forests of central

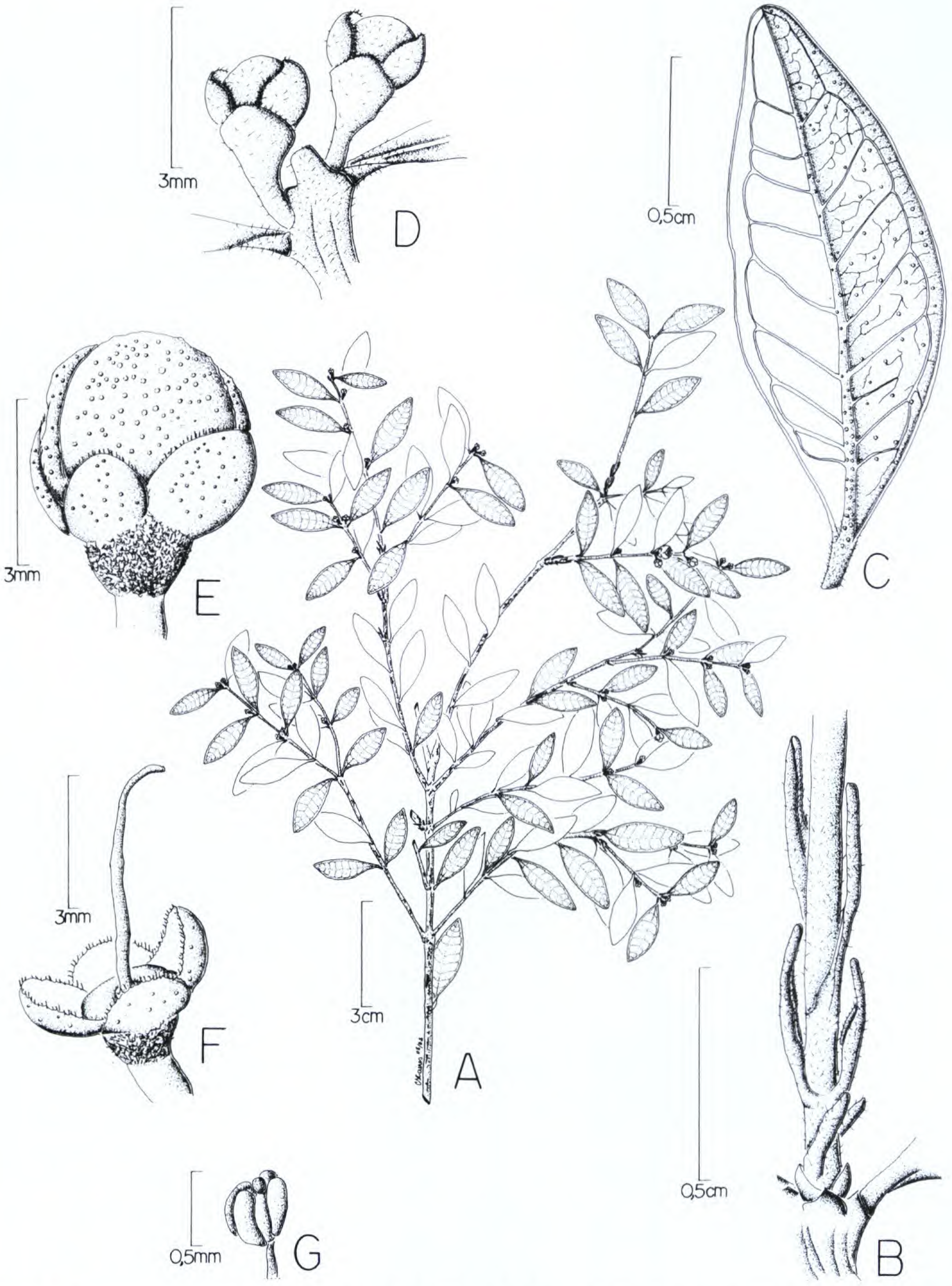

Figure 1. *Eugenia myrciariifolia* Soares-Silva & Sobral. —A. Habit. —B. Cataphylls at base of twigs. —C. Detail of adaxial side of leaf. —D. Detail of inflorescence. —E. Flower bud, with bracteoles detached. —F. Flower after pollination, with bracteoles detached. —G. Stamen with apical gland. From *Soares-Silva 570*.

and western Paraná; until now it has been collected in only four municipalities.

Phenology. Blooming specimens were collected from October to December; fruiting specimens are still unknown.

Etymology. The specific epithet is allusive to the resemblance of this species with some of the genus *Myrciaria*, especially *Myrciaria tenella* (DC.) O. Berg, with which it can be easily confused when sterile due to its small leaves and dense foliation; curiously, one of the vernacular names that we have registered for this species, cambuí, is also largely applied in southern Brazil for species of *Myrciaria*.

Vernacular names. Cambuí, pitangão (from *Lindeman & Haas 2892*).

Affinities. This species is related to *Eugenia oeidocarpa* O. Berg, another southern Brazilian species growing from Paraná to Rio Grande do Sul (Sobral, 2003). The following key presents the characters that set them apart.

KEY FOR DISTINGUISHING *EUGENIA MYRCIARIIFOLIA* AND *EUGENIA OEIDOCARPA* IN SOUTHERN BRAZIL

1a. Twigs without linear cataphylls at base; leaves obovate with revolute margins; petioles to 4 × 0.8 mm; the inflorescences ramiflorous, 2- to 6-florous, the axis to 2 × 0.5 mm; pedicels to 5 × 0.5 mm; flowers glabrous; larger calyx lobes to 3 × 3 mm . . . . . *Eugenia oeidocarpa*

1b. Twigs with linear cataphylls at base; leaves elliptic-lanceolate; petioles to 2 × 0.6 mm; pedicels to 2 × 0.5 mm; flowers pilose, solitary and axillary; larger calyx lobes to 2 × 2 mm . . . . . *Eugenia myrciariifolia*

Additionally, this species shows close resemblance to the protologue of *Eugenia coaetanea* O. Berg (Berg, 1857–1859), another ramiflorous species distinguished from *E. myrciariifolia* and *E. oeidocarpa* by pilose young leaves, linear bracteoles to 4 mm, and flower buds to 8 mm; nevertheless, comparison with this species is problematic since the type was destroyed at B and no isotypes are known. Moreover, although said to be collected in the state of Rio Grande do Sul, no further collections of *E. coaetanea* are known, notwithstanding extensive surveys in the myrtaceous flora of this state (Mattos, 1984; Marchiori & Sobral, 1997; Sobral, 2003).

Paratypes. BRAZIL. **Paraná:** Aranha, *Lindeman & Hass 3432* (MBM, U); Campo Novo, ca. 50 km de Laranjeiras do Sul, *Lindeman & Hass 2892* (MBM, U, UB); Parque Nacional do Iguaçu [municipality of Céu Azul, not registered in label], 100 m W of rio Floriano, *Lindeman & Hass 3544* (MBM, U); Sapopema, Salto das Orquídeas, margem direita do rio Lageado, *Soares-Silva 441* (FUEL, UB), 9 Dec. 1995, *Soares-Silva 570* (FUEL, UB), *Chagas e Silva & Soares-Silva 2056* (FUEL, UB), *Silva 2127* (FUEL, UB), *Medri 744* (BHCB, FUEL), *Pavão et al. s.n.* (FUEL 27498, MO).

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A New Species of *Asarum* (Aristolochiaceae) from China

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ABSTRACT. A new species of *Asarum* L., *A. campaniflorum* Wang Yong & Wang Q. F. (Aristolochiaceae), is described from Hubei Province, China. It belongs to *Asarum* sect. *Heterotropa* (Morren & Decaisne) Braun and is readily distinguishable in having simple bell-shaped flowers and little ornamentation of the calyx. A chromosome count of $2n = 26$ is recorded.

Key words: Aristolochiaceae, *Asarum*, China.

Asarum L. s.l. is a north temperate genus whose center of distribution is eastern Asia. According to the classification system proposed by Cheng and Yang (1983), which has been accepted by previous researchers (Kelly, 1997, 1998), the section *Heterotropa* consists of ca. 50 species that are characterized by perianth tubes of various shapes, orifice rings usually present but sometimes absent, and stamens subsessile or with very short filaments (Cheng & Yang, 1983). During floristic investigation of Jiugongshan Nature Reserve located in southeastern Hubei Province, China, we encountered a new species of *Asarum* with strikingly large bell-shaped flowers whose distinct perianth tube and subsessile stamens indicate its taxonomic placement in section *Heterotropa*. We describe this species on the basis of fresh and live material. A few individuals of this new species are in cultivation at the botanical garden of the Chinese Botanical Institute of Wuhan. These plants have been previously identified as *A. insigne* Diels (Lin et al., 1995), probably due to the similarities of floral morphologies between the two species.

Asarum campaniflorum Wang Yong & Wang Q. F., sp. nov. TYPE: China. Hubei: Jiugongshan Nature Reserve, bamboo bush on slope, yellow sandy soil, 400 m, 23 July 1998, *Wang Yong 2390* (holotype, PE; isotype, WH). Figure 1.

Haec species quoad flores magnos atque perianthii tubum campaniformem intus longitudinaliter crasse plicatum *A. maximi* et *A. insignis* similis, sed ab eis perianthii lobulis suberectis atque tubo intus non papillato-rugoso differt.

Perennial herb; rhizomes short, internodes 5–15 mm long, with thick fleshy adventitious roots clustered at nodes. Leaves 2 or 3 on one branchlet, with petiole 10–30 cm long, the cataphylls at its base ovate, up to 2.5 cm long, densely ciliate, shed when leaves fully grown, blade triangular or oblong-ovate, membranous, 7–20 × 5–14 cm, acute or acuminate at apex, auriculate at base, base of the sinus 1–1.5 cm wide, sparsely pubescent above, with or without white blotches along midvein above, glabrous below, margins mucronate as extensions of secondary veins. Flowers solitary, facing downward, pale purplish green, large, ca. 3 cm across, 3.5 cm long, peduncle 4–6 cm long; perianth tube campanulate, with the lower portion broadly cylindrical, ca. 1.3 cm long, 1.0 cm diam., internally pale yellow-green and with ca. 30 longitudinal smooth ribs, with the upper portion abruptly swollen into a broad bell-shaped tube, ca. 1.0 cm long, 3 cm diam., internally glabrous and pale yellow-green, not constricted, without orifice, the connecting part between upper portion and lower portion flat, internally dark purple, having smooth longitudinal ribs continuous with those on the internal tube surface of the lower portion, perianth lobes broadly triangular-ovate, ca. 1 × 2.5 cm, nearly erect, having a dark purplish crescent toward the middle, triangular, pale yellow-green beneath and continuous with internal tube surface, stamens 12, filaments very short, anthers 4 mm long, with connective obtuse, ovary half-inferior, styles 6, ca. 7 mm long, with bifid apices, the stigma oblong-ovoid, inserted in apex notch, ovary subglobose, ca. 1.5 cm long, 1.7 cm diam., seeds ovate, dark brown, concave on one side, protruding on opposite side, ca. 4 mm long, 2.5 mm wide. Chromosome number $2n = 26$.

Distribution and habitat. *Asarum campaniflorum* is endemic to a low mountainous area in southeastern Hubei Province in central China. It occurs under dense brush dominated by the bamboo species *Phyllostachys nidularia* Munro. The habitats are shaded and moist throughout the year. There are villages and farms scattered around. We suppose that both special ecological requirements and

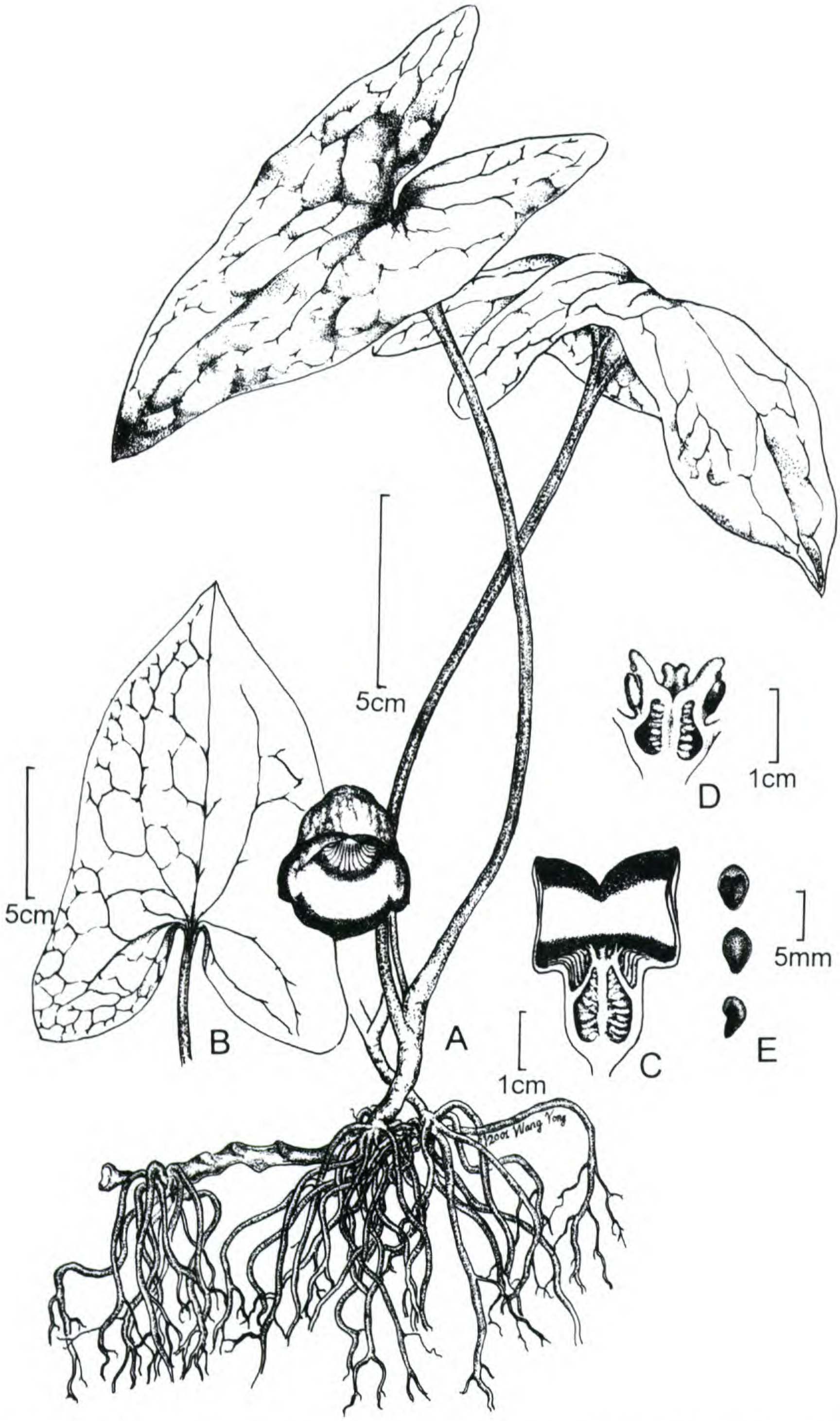

Figure 1. *Asarum campaniflorum* Wang Yong & Wang Q. F. —A. Habit. —B. Leaf blade. —C. Longitudinal section of flower. —D. Styles and stamens, showing longitudinal section of ovary. —E. Seeds, appearance from different views. Drawn from the type gathering, *Wang Yong 2390* (PE).

disturbance by human activities contribute to the rarity of this species in nature.

Species in *Asarum* sect. *Heterotropa* have diverse modifications of their flowers, for example, contrasting colors of the perianth lobes, constriction or dilation of calyx ornamentation or surface sculpturing such as tubercles, pulvinus, orifice rings, and longitudinal or reticulate ridges (Kelly, 1997, 1998; Sugawara, 1988). In comparison to other species in section *Heterotropa*, the flowers of *Asarum campaniflorum* are more simplified. They have large perianth tubes with the perianth lobes short and reduced. The calyces are smooth without constriction or orifice rings, and papillate, pulvinate or dilated areas are absent. Only parallel longitudinal ridges are present at the base of the perianth inner surface. The flower color of *A. campaniflorum* is basically pale purplish green, and no strongly color-contrasting area is present. The flowers face downward throughout anthesis and thus the inner parts of the flowers cannot easily be seen by an observer in the field. Among the species of section *Heterotropa*, *Asarum sagittarioides* C. F. Liang is similar to *A. campaniflorum* in vegetative morphology. Both species are robust perennials with a pair of large membranous leaves in each branchlet, a thick cluster of fleshy adventitious roots, leaf margins mucronate as extensions of secondary veins, and an auriculate leaf base with a wide sinus. However, flowers in *A. sagittarioides* differ from those of *A. campaniflorum* by their deeply constricted perianth tubes with conspicuous orifice rings at the throat and perianth lobes with prominent papillae at their base. *Asarum wulingenses* C. F. Liang and *A. longerhizomatosum* C. F. Liang & C. S. Yang are the closely allied species of *A. sagittarioides*, but they differ from *A. campaniflorum* in having smaller (7–17 × 5–9 cm in *A. wulingenses*, 8–14 × 5–8 cm in *A. longerhizomatosum*) chartaceous leaves with narrower sinuses (rounded to cuneate in *A. longerhizomatosum*, cuneate in *A. wulingenses*) at leaf base and gradually enlarged perianth tubes with orifice rings at the throats (Cheng & Yang, 1988; Liang, 1975).

Two other species in *Asarum* sect. *Heterotropa*, *A. maximum* Hemsley and *A. insigne*, appear to be closely allied to *A. campaniflorum*. The floral morphologies of these three species are similar in having numerous (ca. 30) longitudinal smooth ridges at the base of the inner surface of the perianth tubes. In contrast to the simple bell-shaped flowers of *A. campaniflorum*, the flowers of the other two species have larger and spreading perianth lobes and perianth tubes that are externally concave, forming three semicircular pulvinate areas basal to the lobes. These pulvinate areas in the flowers of *A. maximum* and *A. insigne* are white or pinkish, strongly contrasting in color to the dark velvet margins of the perianth lobes and the central portion of the flowers. In addition, the flowers of these two species tilt upward, making the flowers easily seen by observers.

A chromosome count of $2n = 26$ was obtained for *Asarum campaniflorum*, using the methodology of Sugawara and Ogisu (1992), from fresh root tips. Sugawara and Ogisu (1992) revealed that *A. maximum* shared a chromosome number of $2n = 26$ (the chromosome number of *A. insigne* is still unknown). These results contradict the earlier suggestions that the chromosome number $2n = 24$ is characteristic in *Heterotropa* (Sugawara, 1981; Yinger, 1983; Kelly, 1997). Further investigations are needed to improve our knowledge.

Paratypes. CHINA. **Hubei:** Tongshan County, Gaohu Village, 350 m, 5 July 1998, *Wang Yong 2877* (WH); 2 km along the road from Gaohu Village to Jiugongshan Town, 450 m, 24 Mar. 1989, *Ye Qigang & Chen Shusen 5476* (WHBI).

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Pseudopogonatherum filifolium, the Correct Name for *P. capilliphyllum* (Poaceae: Andropogoneae)

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ABSTRACT. In the course of studying the systematics of the subtribe Saccharinae (Poaceae: Andropogoneae), it was noticed that the name *Pseudopogonatherum capilliphyllum* S. L. Chen, published to replace the legitimate name *Eulalia filifolia* S. L. Chen, is nomenclaturally superfluous and therefore illegitimate. A new combination in *Pseudopogonatherum*, *P. filifolium* (S. L. Chen) H. Yu, Y. F. Deng & N. X. Zhao, is proposed here.

Key words: China, *Eulalia*, Poaceae, *Pseudopogonatherum*.

Pseudopogonatherum A. Camus (1921; Poaceae: Andropogoneae: Saccharinae) has been widely accepted as a distinct genus of six species distributed in southeastern Asia and Australia (Hubbard, 1929; Bor, 1960; Watson et al., 1985; Tzvelev, 1989; Chen, 1997; Xu, 1997, 1999). The genus is characterized by linear leaves, a digitate inflorescence, with the upper glume usually awned, and the upper palea absent. The genus was included in *Eulalia* Kunth (s.l.) by some authors (Keng, 1939, 1959; Clayton & Renvoize, 1986), and was treated as a subgenus of *Eulalia* by Pilger (1940). In recent studies, however, *Pseudopogonatherum* has been treated separately (Hilu & Wright, 1982; Chen et al., 1990; Yu, 2000; Yu et al., 2000). Additionally, Haines (1924) published what is now treated as a synonym of the genus, *Puliculum* Stapf ex Haines, including a single species, *P. articulatum* (Trinius) Stapf ex Haines.

Chen (1962: 249, 287) published the name *Eulalia filifolia* for a new species with *F. Courtois 12570*, from Anhui Province in eastern China, as the holotype. She cited in synonymy "*Pseudopogonatherum filifolium* S. L. Chen," a name that had not been previously published and which is therefore invalid under Article 34.1(c) of the *St. Louis Code* (Greuter et al., 2000). When she transferred *E. filifolia* to *Pseudopogonatherum*, Chen (1980: 489) published a new name, *P. capilliphyllum* S. L. Chen, explaining that [translated from Chinese] "*P. filifolium* was illegitimate because it was originally cited in synonymy." In fact, *P. capilliphyllum* is the illegitimate name because it was nomenclaturally superfluous when published (Art. 52.1), because the earlier legitimate name, *E. filifolia* (the epithet of which should have been used), was cited in synonymy. The supposed earlier homonym, *P. filifolium*, is invalid and therefore has no nomenclatural status. Under the genus *Pseudopogonatherum*, a new combination, *P. filifolium*, would be legitimate and is required as the correct name.

Pseudopogonatherum filifolium (S. L. Chen) H. Yu, Y. F. Deng & N. X. Zhao, comb. nov. Basionym: *Eulalia filifolia* S. L. Chen, Gram. Orient. Sin. 249, f. 165, 287. 1962. *Pseudopogonatherum capilliphyllum* S. L. Chen, Acta Phytotax. Sin. 18: 489. 1980, nom. illeg. (Art. 52.1). TYPE: China. Anhui: Jingde, 25 Sep. 1915, *F. Courtois 12570* (holotype, NAS).

Acknowledgments. We thank Nicholas Turland (MO) for discussing the nomenclatural status of this species and providing some references for our studies. The project was supported by the National Natural Science Foundation of China (39670061; 39780084) and the Chinese Academy of Sciences (KZ952-S1-112; STZ-00-20).

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Novelty in *Tibetia* (Leguminosae) for China

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ABSTRACT. A new white-flowered form is described as *Tibetia himalaica* (Baker) H. P. Tsui forma *alba* X. Y. Zhu (Leguminosae) from Sichuan Province, China.

Key words: China, Leguminosae, *Tibetia*.

In identifying specimens of Leguminosae in PE for the *Flora of China*, the present author found several specimens that are described as a new form, *Tibetia himalaica* (Baker) H. P. Tsui forma *alba* X. Y. Zhu. This differs from the typical form in having white flowers. The typical *T. himalaica* (Baker) H. P. Tsui forma *himalaica* has dark purple, violet, or blue flowers. The species was originally described in 1879 by Baker as *Gueldenstaedtia himalaica* and later moved to *Tibetia* by Tsui in 1979.

The occasional appearance of a white-flowered variant of a purple- or blue-flowered species of legume is not uncommon. White-flowered forms may occur in otherwise blue-flowered species, perhaps due to a single-gene difference. I would agree with this if these different flower colors appeared within a single population. For the new form, the white flower color was observed as a different and separate population, and the two flower colors were clearly distinctive from one another. During my expedition to Sichuan and Xizang in August of 2000, I investigated two populations in fields of Dêgê Xian in Sichuan Province. For these, one population had only white-flowered plants while the other displayed only blue flowers. Both populations were separated by 100 m and were never mixed in flower color. There are also many duplicate specimens of *T. himalaica* deposited in PE, and I have identified all as *Tibetia* specimens. White flowers were never mixed with blue flowers in collections from the same population. Based on the above observations, I treat the white-flowered plants as a new form.

A similar example can be seen in my treatment on *Oxytropis anertii* Nakai ex Kitagawa forma *albiflora* (Zh. J. Zong & X. R. He) X. Y. Zhu & H. Ohashi (Zhu & Ohashi, 2000). Here I also observed the white-flowered population of *O. anertii* forma *albiflora* to be absolutely separate from the violet or blue-flowered population of *O. anertii* forma *anertii* in the Changbai Mountains of China, although they share a close relationship.

Tibetia himalaica (Baker) H. P. Tsui forma **alba** X. Y. Zhu, forma nov. TYPE: China. Sichuan Province: Kangding, Zheduoshan, alpine meadow, alt. 4000 m, 28 July 1963, *K. J. Guan & Wang W. C. 997* (holotype, PE; isotype, PE).

A typo floribus albis differt.

This form is different from the typical one in having white flowers.

Distribution. This white-flowered form, collected from Kangding Xian and Dêgê Xian in western Sichuan, China, was observed to grow in alpine meadows or along riverbanks at 3700–4000 m altitude, where it is apparently restricted.

Paratype. CHINA. **Sichuan:** Dêgê Xian, Babang Xiang, Shanbaike, on meadow of riverbank, alt. 3700 m, 9 July 1974, *s. coll. 7341* (PE). [Other collections made of the Dêgê Xian white-flowered population were inadvertently lost by the flooding from mountain torrents in 2000.]

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Una Nueva Especie de *Monochaetum* (Melastomataceae) del Parque Internacional La Amistad, Costa Rica

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RESUMEN. *Monochaetum vestitum*, la cual se caracteriza por su hábito decumbente, flores solitarias e hipantio con denso indumento que entremezcla tricomas adpresos y diminuto barbelados y tricomas glandulares, es descrita de la Cordillera de Talamanca en Costa Rica. Esta especie es ilustrada y comparada con la superficialmente similar y simpátrica *M. trichophyllum* Almeda pero ésta no parece tener estrecha relación con sus congéneres.

ABSTRACT. *Monochaetum vestitum*, which is characterized by its decumbent habit, solitary flowers, and dense hypanthial indument of appressed minutely barbellate and smooth gland-tipped hairs, is described from Costa Rica's Cordillera de Talamanca. It is illustrated and compared to the superficially similar and sympatric *M. trichophyllum* Almeda, but it appears to have no close relatives among described congeners.

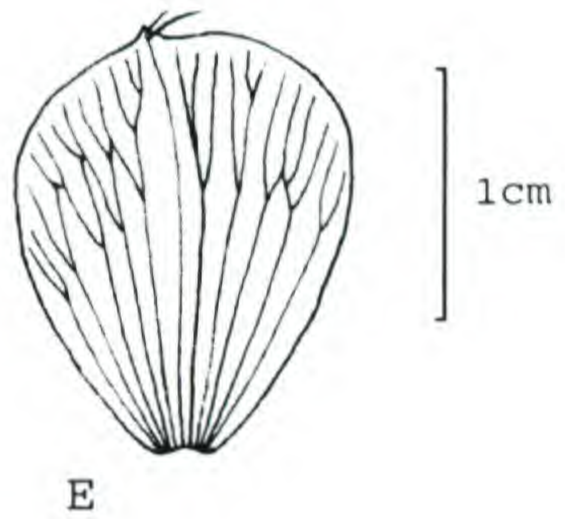
Key words: Costa Rica, Melastomataceae, *Monochaetum*.

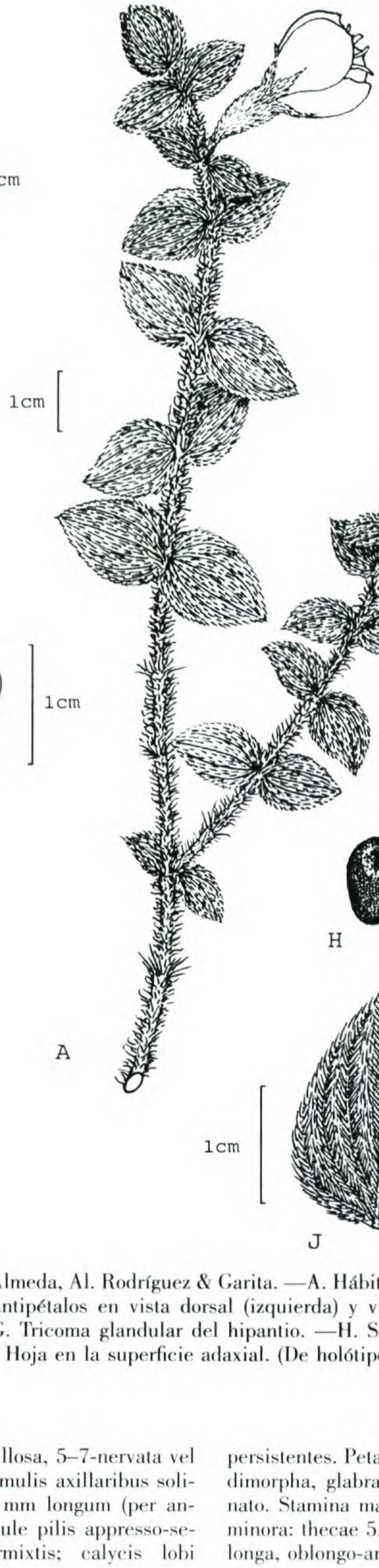
Monochaetum (DC.) Naudin es un género con 45–50 especies restringidas a los ambientes montañosos entre México y el sur de América Central hasta Perú y el este de Venezuela y Guayana. *Monochaetum* se caracteriza por su hábito arbustivo, hojas opuestas, con 3–11 nervios basales o saliendo muy cerca de la misma, el margen entero o denticulado, flores 4-meras, estambres dimórficos, anteras con conectivo apendiculado dorsalmente, ovario súpero y 4 loculado, frutos capsulares y envueltos por el hipantio y finalmente se distingue por sus diminutas semillas en ocasiones cocleadas.

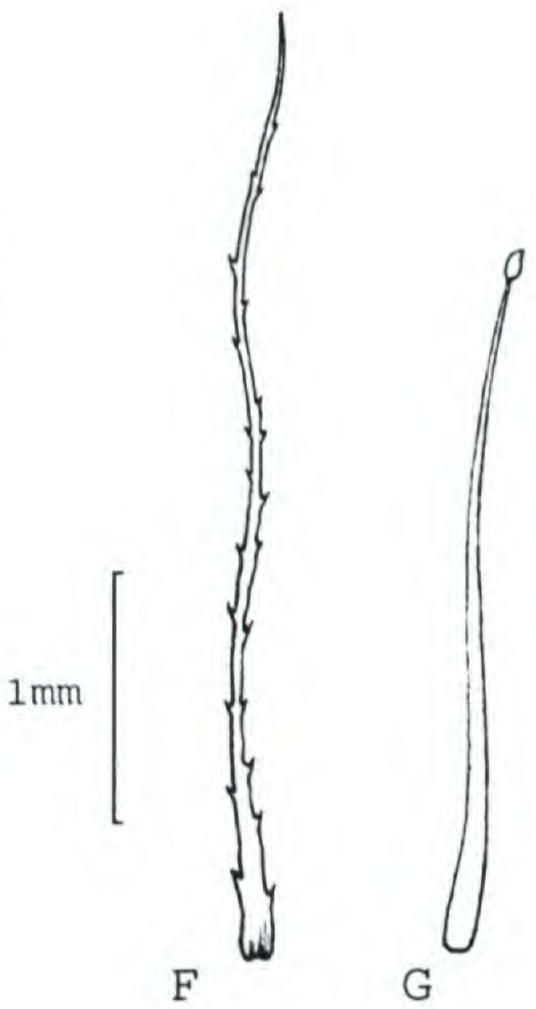
Hasta la fecha, diez especies de *Monochaetum* han sido registradas en Costa Rica (Almeda, 1978, 1993). La especie aquí descrita, corresponde a una insólita y nueva especie, la cual fue colectada y observada de una reducida población en Sabanas Dúrika, un hábitat con extrema dominancia de *Blechnum buchtienii* Rosenstock (Blechnaceae) y que corresponde a una porción del Parque Internacional La Amistad en Costa Rica.

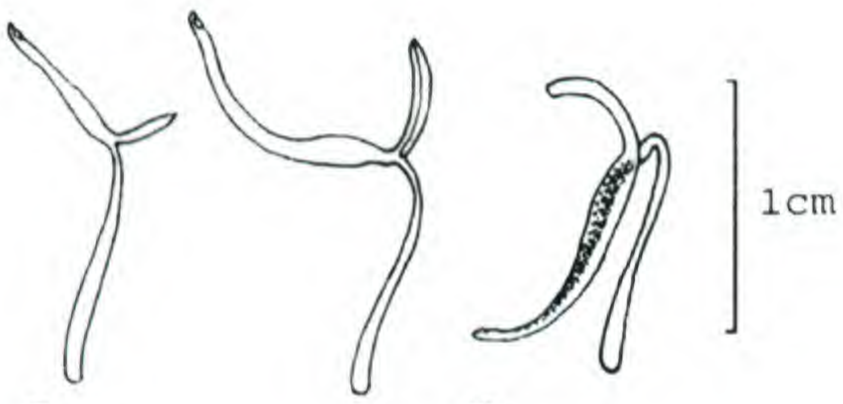
Monochaetum vestitum Almeda, Al. Rodríguez & Garita, sp. nov. TIPO: Costa Rica. Limón: Talamanca, Bratsi, Cordillera de Talamanca, Sabanas Dúrika, Parque Internacional La Amistad, 9°26′N, 83°20′20″W, 2300 m, 8 Mar. 2003, *A. Rodríguez 7876* (holótipo, INB; isótipo, CR). Figura 1.

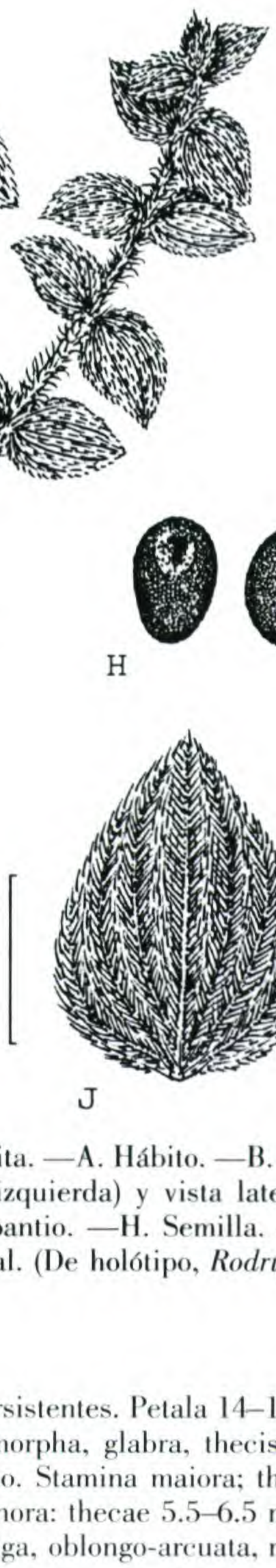
Suffrutex decumbens; ramuli teretes sicut petioli dense pilis patulis barbellatis 1.75–3.75 mm longis induti. Petioli 0.5–2 mm longi; lamina 0.7–2.5 × 0.5–1.5 cm ovata vel elliptico-ovata apice acuta basi obtusa vel subcordata,

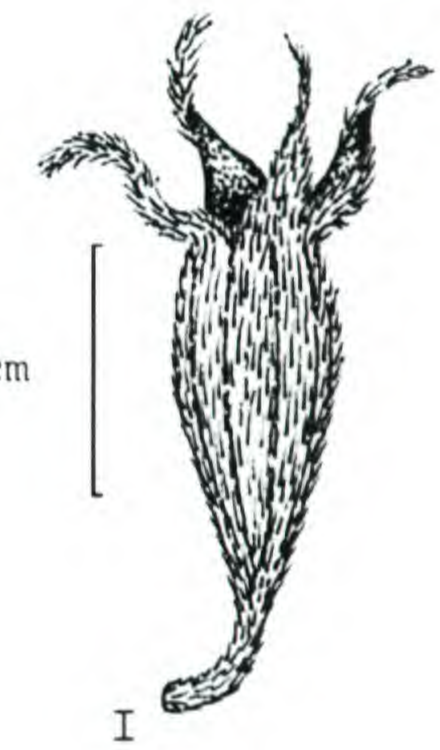












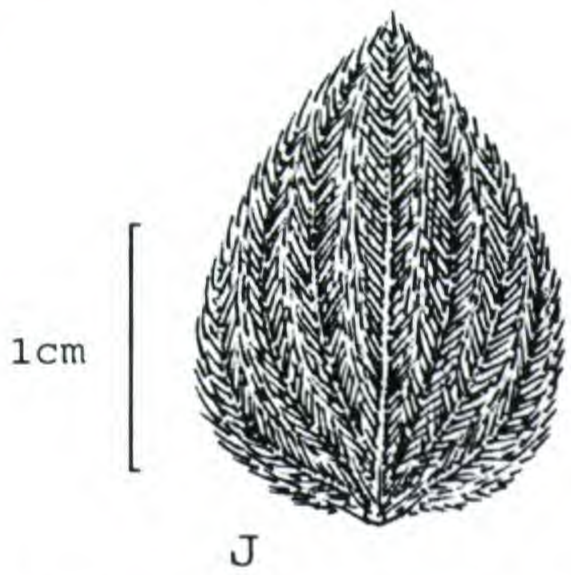


Figura 1. *Monochaetum vestitum* Almeda, Al. Rodríguez & Garita. —A. Hábito. —B. Pistilo. —C. Estambre antisépalo en vista lateral. —D. Estambres antipétalos en vista dorsal (izquierda) y vista lateral (derecha). —E. Pétalo. —F. Tricoma alargado del hipantio. —G. Tricoma glandular del hipantio. —H. Semilla. —I. Hipantio en los frutos. —J. Hoja en la superficie abaxial. —K. Hoja en la superficie adaxial. (De holótipo, *Rodríguez 7876.*)

supra et subtus dense ferrugineo-villosa, 5–7-nervata vel 5–7-plinervata. Flores 4-meri in ramulis axillaribus solitarii. Hypanthium (ad torum) 8–9 mm longum (per anthesin) extus sicut sepala densiuscule pilis appresso-setulosum pilis glanduliferis intermixtis; calycis lobi persistentes. Petala 14–16 × 11–14 mm obovata. Stamina dimorpha, glabra, thecis subulatis, poro dorsaliter inclinato. Stamina maiora; thecae 6.5–8 mm longae. Stamina minora: thecae 5.5–6.5 mm longae. Semina 0.5–0.75 mm longa, oblongo-arcuata, muriculata.

Hierba fruticosa, decumbente, entre 30–50 cm. Entrenudos teretes, denso y ferrugíneo hirsutos, tricomas 1.75–3.75 mm, leve ascendentes, diminuto barbelados. Ramitas viejas con pubescencia persistente a leve caediza, corteza aparentemente no exfoliante. Hojas maduras del mismo nudo iguales a leve desiguales; peciolos 0.5–2 × 0.5 mm; lámina membranácea, entera, 0.7–2.5 × 0.5–1.5 cm, ovada a ovado-elíptica, 5–7-nervada o plinervada, ápice agudo, base obtusa a subcordada, margen entero, superficie adaxial y abaxial con densa y ferrugínea pubescencia vilosa y ascendente. Flores solitarias, pseudo-axilares y generalmente terminando en cortas ramitas, 4-meras; bracteolas 0.5–0.8 × 0.4–0.6 cm, similares en forma a hojas principales, pero reducidas en tamaño; pedicelos (en flores) 0.4–1 cm y 0.8–2 cm en frutos. Hipantio (en antesis) 8–9 mm largo hasta el toro, 4–5 mm ancho, en frutos hasta 14 × 6 mm, levemente 8-acostillado (distinguible en frutos), cilíndrico y campanulado, con densa y ferrugínea pubescencia vilosa y ascendente, entremezclando esparcidos tricomas glandulares. Lobos del cáliz persistentes (aún en frutos), 8–9 mm largo, 2–2.5 mm ancho en la base, delgado triangulares, superficie externa con densa y ferrugínea pubescencia vilosa y ascendente, entremezclando esparcidos tricomas glandulares, principalmente hacia la parte distal, superficie interna glabra. Pétalos 14–16 × 11–14 mm, magenta, obovados, apiculados en el ápice, glabros, con 1–3 pelos sobre el mucro apical. Estambres dimórficos, dehiscencia apical a través de un poro dorsal e inclinado; más largos (antipétalos) leve geniculados, filamento 8–9 mm, linear, antera 6.5–8 mm, subulada, incurva, conectivo prolongado dorsalmente y formando un apéndice incurvo, 4–5.5 mm, linear-oblongo; más pequeños (antisépalos) más o menos erectos, filamento 8.5–10 mm, antera 5.5–6.5 mm, subulada, nada a leve incurva, conectivo prolongado dorsalmente y formando un apéndice nada a leve incurvo, 3–4 mm, linear-oblongo. Ovario súpero, oblongo-obovoide, con pubescencia corto vilosa en el tercio distal. Estilo 15–17 mm, declinado hacia uno de sus lados, opuesto a los estambres más largos. Cápsulas semileñosas, loculicidas, erectas al madurar y envueltas por el hipantio; semillas 0.5–0.75 mm, oblongo-arqueadas, muriculadas, café.

Fenología. Flores y frutos en marzo.

Distribución. Endémica de Costa Rica, en la vertiente Atlántica de la cordillera de Talamanca, 2300 m. La especie es conocida únicamente de una reducida población en la localidad tipo, Sabanas Dúrika, la cual se caracteriza por presentar un ecosistema muy particular ya que corresponde a áreas abiertas, con dominancia extrema de *Blechnum buchtienii,* con suelos mal drenados y saturados de humedad la mayor parte del año y temperaturas que podrían llegar hasta 0 grados.

Monochaetum vestitum se reconoce por su hábito decumbente, hojas con 5–7 nervios desde la base, presencia de indumento denso, ferrugíneo y viloso en la mayor parte de la planta, incluyendo tallitos, hojas, pedicelos, hipantio y sépalos en el lado externo, donde en estos 2 últimos se entremezclan tricomas glandulares; además, se distingue por sus flores solitarias y semillas oblongo-arqueadas, muriculadas.

El indumento del hipantio (en la antesis) y de los lobos del cáliz es notable ya que los tricomas son tan densos que hacen obscuramente visible la superficie hipantial y del cáliz. Esta es una característica única entre las especies Mexicanas y de América Central.

Dos especies endémicas de Costa Rica, *Monochaetum neglectum* Almeda y *M. talamancense* Almeda, y *M. trichophyllum* Almeda de Costa Rica y Panamá son las únicas especies del Sur de América Central caracterizadas por su hábito decumbente. Estas tres especies tienen semillas cocleadas, lisas y lateralmente compresas. Respecto a lo anterior, éstas difieren de *M. vestitum* debido a que esta última tiene semillas más oblongo-arqueadas que cocleadas, no son lateralmente compresas y la superficie es distintivamente muriculada. En este trío de especies, *M. vestitum* es más similar a *M. trichophyllum.* Estas dos especies, las cuales son aparentemente simpátricas en Sabanas Dúrika, comparten un indumento compuesto de esparcidos tricomas sobre los internudos y una conspicua pubescencia sobre la lámina foliar y los peciolos. En *M. trichophyllum,* sin embargo, los tricomas internudales son lisos, la lámina es elíptica a ovado-elíptica, los peciolos más largos [2–10(–17) mm], las flores son comúnmente producidas en dicasios simples o compuestos (aunque a menudo, por aborción, son producidas flores solitarias en cortas ramitas laterales), el hipantio está cubierto con esparcida pubescencia compuesta principalmente de tricomas glandulares que hacen poco visible la superficie hipantial, los pétalos son rosado pálido (vrs. magenta) y los lobos del cáliz son reflexos (vrs. erectos o ascendentes). En vista de estas substanciales diferencias, *M. vestitum* no parece estar particularmente relacionado a otras especies con hábito decumbente y no parece ser similar a ningún otro congénere con un hábito erecto.

Agradecimientos. Deseamos agradecer al Gobierno de Los Países Bajos (Holanda) quienes a través del Proyecto Ecomapas conducido por el Instituto Nacional de Biodiversidad (INBio) financiaron la gira de campo donde fue posible encontrar esta nueva especie. Además, la investigación fue posible gracias al convenio de cooperación entre el Ministerio de Ambiente y Energía (MINAE) e INBio con el fin de completar el Inventario Nacional de Biodiversidad.

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Two New Species of *Draba* (Brassicaceae): *D. mieheorum* from Tibet and *D. sagasteguii* from Peru

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ABSTRACT. The new Tibetan *Draba mieheorum* and Peruvian *D. sagasteguii* (Brassicaceae) are described and illustrated. The distinguishing characters separating each species from its nearest relatives are discussed.

Key words: Brassicaceae, China, *Draba*, Peru, Tibet.

Recent collections of Brassicaceae from Tibet (China) and Peru were sent to me for determination. Each collection included a new species of *Draba* named below in honor of its principal collector(s).

Draba mieheorum Al-Shehbaz, sp. nov. TYPE: China. Tibet (Xizang): Upper Rongshar valley, S-facing slope, *Juniperus indica* scrub, 4330 m, 28°10′N, 86°27′E, 31 Aug. 1999, *Georg & Sabine Miehe, with K. Koch 99-182-25* (holotype, MO). Figure 1.

Herba perennis caespitosa, ca. 11 cm alta. Folia basalia rosulata, sessilia, oblonga vel lanceolata, 1–2 cm × 3–5 mm; pilis brevistipitatis vel subsessilis, stellatis, 4–6-radiatis praeditis, 0.1–0.4 mm diam.; folia caulina 3 vel 4. Racemi 4–7-flori, ebracteati; pedicelli fructiferi divaricati, 8–12 mm longi, tomentosi. Sepala 3–3.5 mm longa; petala alba, spathulata, 6–7 × 3–5.5 mm; ovula 26–30. Fructus oblongo-lineari, compressi, 15–18 × 3–3.5 mm, pubescentes, pilis stellatis, basi et apice subacuti; stylus 1–1.5 mm longus, pilosus; semina ovata, biseriata, ca. 1 × 0.7 mm longa.

Perennial, caespitose herbs ca. 11 cm tall, sparsely tomentose throughout except on petals; caudex unbranched, ca. 5 mm diam., covered with leaf remains of previous years; trichomes stellate, minutely stalked to subsessile, 0.1–0.4 mm diam., cruciform or 4- to 6-rayed, often 1 or 2 rays either forked or 3-branched; stems erect, branched above, sparsely pubescent. Basal leaves densely rosulate, persistent, sessile, oblong to lanceolate, 1–2 cm × 3–5 mm, tomentose with stellate trichomes, base cuneate, margin few-toothed or subentire, apex acute; cauline leaves 3 or 4, sessile, oblong, similar to basal leaves, acropetally smaller. Racemes 4- to 7-flowered, ebracteate, elongated in fruit; fruiting pedicels 8–12 mm, divaricate, straight, tomentose all around with stellate trichomes. Sepals oblong, purplish green, 3–3.5 × 1–1.3 mm, erect, abaxially pubescent; petals white, spatulate, 6–7 × 3–5.5 mm, apex rounded; claw 2–2.5 mm; filaments 3.5–4 mm; anthers oblong, 0.6–0.8 mm; ovules 26 to 30 per ovary. Fruit oblong-linear, 15–18 × 3–3.5 mm, not appressed to rachis, compressed parallel to septum, not twisted; valves uniformly pubescent with stellate trichomes, obscurely veined basally, base and apex subacute; style 1–1.5 mm, pilose; seeds brown, ovate, biseriate, ca. 1 × 0.7 mm.

Draba mieheorum is most closely related to *D. subamplexicaulis* C. A. Meyer, a species distributed in China (Qinghai, Shaanxi, Sichuan, and Xinjiang Provinces), Kazakhstan, Kyrgyzstan, Mongolia, Russia, and Uzbekistan (Pohle, 1925; Schulz, 1927; Zhou et al., 2001). Both species are caespitose perennials with few-leaved stems, sessile cauline leaves, white flowers, numerous seeds per fruit, and oblong-linear flattened fruits. *Draba mieheorum* is easily distinguished by having exclusively stellate trichomes throughout the plant, non-ciliate basal leaves, non-amplexicaul cauline leaves, divaricate fruiting pedicels, sepals 3–3.5 mm long, apically rounded petals 6–7 mm long, oblong anthers 0.6–0.8 mm long, and pubescent styles. By contrast, *D. subamplexicaulis* has stellate, stalked forked, and simple trichomes on the stems and fruiting pedicels, often ciliate basal leaves, usually subamplexicaul cauline leaves, erect-ascending fruiting pedicels, sepals 2–2.7 mm long, apically emarginate petals 3–5 mm long, ovate anthers 0.4–0.5 mm long, and glabrous styles.

Draba sagasteguii Al-Shehbaz, sp. nov. TYPE: Peru. La Libertad: Pataz, alrededores de Minera La Estrella (Huaylillas), 4000 m, 8°10.8′S, 77°18.2′W, 23 Aug. 2002, *Abundio Sagástegui A. & M. Zapata 17046* (holotype, MO; isotypes not seen, F, HAO). Figure 2.

Herba perennis suffruticosa, 30–37 cm alta; caules lignosi, 2–3 mm diam. Folia caulina numerosa, persistentia, sessilia, oblonga, oblongo-elliptica, vel oblongo-ovata, 8–12 × 4–5 mm, dense tomentosa; pilis brevistipitatis vel

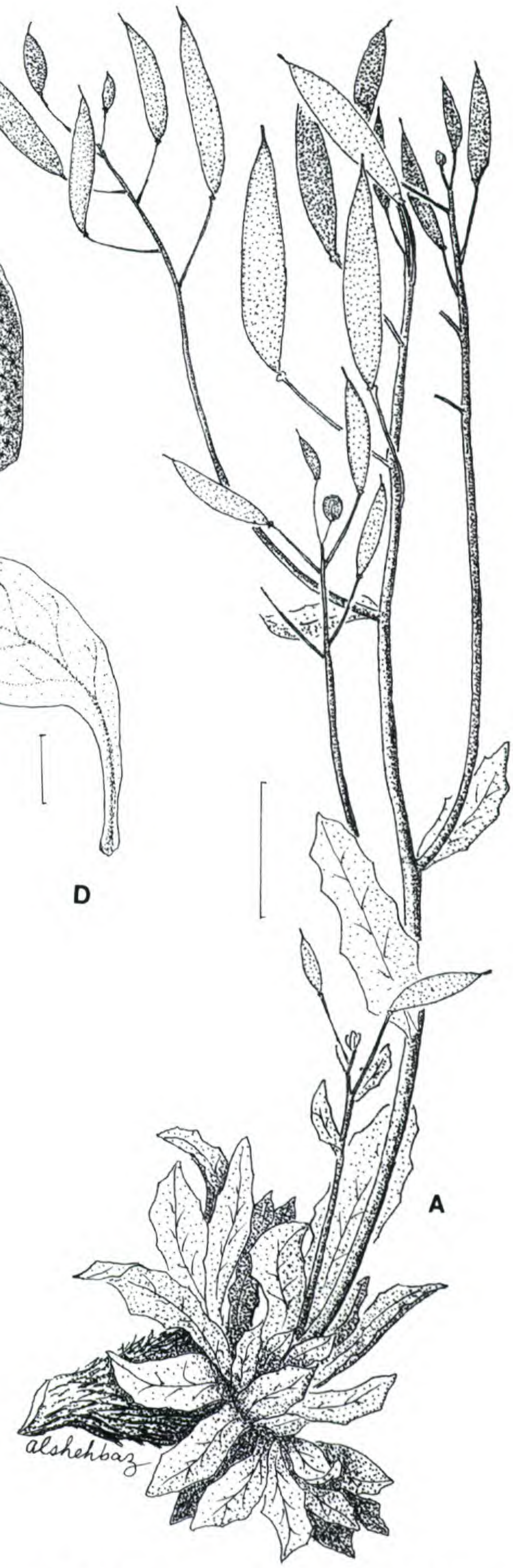

Figure 1. *Draba mieheorum* Al-Shehbaz. —A. Plant. —B. Leaf trichomes. —C. Sepal. —D. Petal. —E. Fruit. Scale: A = 1 cm, B = 0.3 mm, C–E = 1 mm. Drawn by Al-Shehbaz from the holotype (*G. & S. Miehe & K. Koch 99-182-25*, MO).

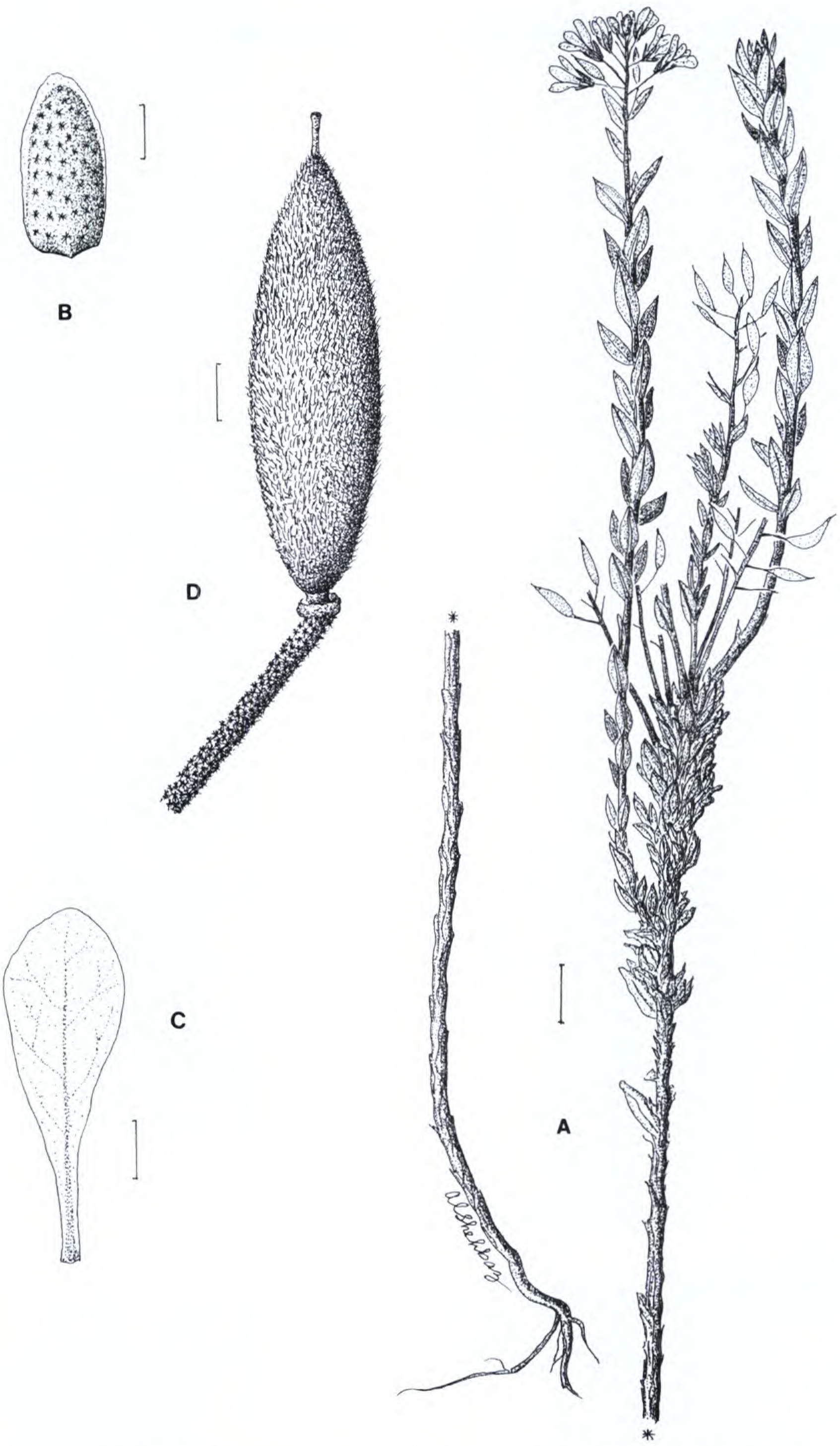

Figure 2. *Draba sagasteguii* Al-Shehbaz. —A. Plant. —B. Sepal. —C. Petal. —D. Fruit and pedicel. Scale: A = 1 cm, B–D = 1 mm. Drawn by Al-Shehbaz from the holotype (*Sagástegui & Zapata 17046*, MO).

subsessilis, stellatis, 0.2–0.4 mm diam., radiis 2- vel 3-fidibus. Racemi 9–25-flori, ebracteati vel basi bracteati; pedicelli fructiferi divaricati, stellati, 4–8 mm longi. Sepala 3–3.5 mm longa; petala flava, spathulata, 6–7 × 2–2.5 mm; ovula 16–22. Fructus anguste oblongi vel oblongo-lanceolati, compressi, 8–12 × 2–2.5 mm, pubescentes, pilis simplicibus vel furcatis praeditis; stylus 0.7–1 mm longus; semina compressa, ovato-oblonga, 1–1.4 × 0.6–0.8 mm.

Suffrutescent perennial herbs 30–37 cm tall; stems woody, simple at least basally, simple or few-branched above or throughout, usually several from base, 2–3 mm diam., lower nodes with thickened basal remnants from leaf bases. Leaves all cauline, numerous, persistent even after drying, crowded, sessile; petiole absent; leaf blade oblong, oblong-elliptic, to oblong-ovate, 8–12 × 4–5 mm, densely tomentose with short-stalked to subsessile stellate trichomes 0.2–0.4 mm diam., with 2- or 3-fid rays, simple trichomes completely lacking, base cuneate, margin entire, apex acute; midvein prominent abaxially. Racemes 9- to 25-flowered, corymbose, elongated in fruit; bracts absent or usually subtending lowermost 2 or 3 flowers; fruiting pedicels divaricate, straight, stellate pubescent, 4–8 mm long. Sepals purplish green, erect, oblong, caducous, 3–3.5 × 1–1.5 mm, sparsely pubescent with stellate trichomes, subequal at base, margin narrowly membranous; petals yellow, spatulate, short-clawed, 6–7 × 2–2.5 mm, apex rounded; filaments yellow, 3.5–5 mm long; anthers ovate, ca. 0.6 mm long; nectar glands confluent, subtending bases of all filaments; ovules 16 to 22 per ovary. Fruit narrowly oblong to oblong-lanceolate, strongly compressed, not twisted, 8–12 × 2–2.5 mm; valves densely pubescent with a mixture of simple or subsessile furcate trichomes, midvein inconspicuous; style slender, 0.7–1 mm long; stigma capitate, entire; seeds reddish brown, compressed, ovate-oblong, 1–1.4 × 0.6–0.8 mm.

Draba sagasteguii is closely related to the Colombian and Ecuadorian *D. confertifolia* Turczaninow, *D. pycnophylla* Turczaninow, and *D. hallii* Hooker f. (Schulz, 1927), all of which grow primarily in the páramos, and the last also grows in Peru. All four species have woody stems, sessile cauline leaves, racemes that are ebracteate or only the lowermost few flowers bracteate, purplish green oblong sepals, spatulate petals, confluent nectar glands, divaricate fruiting pedicels, similar fruit shape and size, and compressed seeds 1–1.5 mm long. However, *D. sagasteguii* is easily distinguished from these species by having yellow instead of white flowers and an adaxial leaf surface with exclusively stellate trichomes instead of a mixture of stellate, forked, and simple or exclusively simple trichomes. From *D. confertiflora*, *D. sagasteguii* can also be distinguished by having smaller flowers (sepals 3–3.5 mm vs. (3.2–)4–5(–6) mm long, petals 6–7 × 2–2.5 mm instead of (6–)8–11(–12) × 3–5 mm long) and shorter styles (0.7–1 vs. 2–5 mm long). From both *D. hallii* and *D. pycnophylla*, *D. sagasteguii* is also separated by having entire instead of dentate leaves (1- to 4-toothed on each side) and larger flowers. In both *D. hallii* and *D. pycnophylla* the sepals are 1.8–2.5 mm long (instead of 3–3.5 mm in the new species), and the petals are 3.5–5 mm long (instead of 6–7 mm). *Draba hallii* often has racemes bracteate throughout, whereas in *D. sagasteguii* the raceme is ebracteate or only the lowermost few flowers are bracteate. Finally, in *D. pycnophylla* the fruits are pubescent with exclusively stellate trichomes, whereas those of *D. sagasteguii* are pubsecent with simple and forked trichomes, similar to those of *D. hallii* and *D. confertiflora*.

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A Synopsis of the South American *Neuontobotrys* (Brassicaceae)

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ABSTRACT. Five species of *Neuontobotrys* (Brassicaceae) are recognized, and a key to the species and typification of the genus are presented. A new species, *N. elloanensis*, is described and illustrated from Chile, and its distinguishing characters from nearest relatives are given. The new combinations *N. linearifolia*, *N. deserticola*, and *N. robusta* are proposed.

RESUMEN. Se reconocen cinco especies de *Neuontobotrys* (Brassicaceae) y se presenta una clave para las especies y la tipificación del género. Se describe e ilustra una especie nueva de Chile, *N. elloanensis*, y se presentan los caracteres que la distinguen de sus parientes más cercanos. Se proponen las siguientes combinaciones nuevas: *N. linearifolia*, *N. deserticola* y *N. robusta*.

Key words: Argentina, Bolivia, Brassicaceae, Chile, *Eremodraba*, *Neuontobotrys*, *Sisymbrium*.

Schulz (1924) segregated *Neuontobotrys* O. E. Schulz (Brassicaceae) from *Sisymbrium* L. and treated it as a monotypic genus based on the Chilean *Sisymbrium linifolium* Philippi. He (Schulz, 1932) added another Chilean species, *N. berningeri* O. E. Schulz, and the genus included two species until the present (Appel & Al-Shehbaz, 2003). Schulz (1924, 1936) distinguished *Neuontobotrys* from *Sisymbrium* by having nearly veinless instead of prominently veined fruit valves. However, the fruit valves in the type species of *Neuontobotrys* have a distinct midvein. Unconvinced by Schulz's delimitation of *Neuontobotrys*, Baehni and Macbride (1937) and Macbride (1938) reduced the genus to synonymy of *Sisymbrium*.

Based on molecular studies and critical evaluation of morphology (Warwick et al., 2002; Warwick & Al-Shehbaz, 2003), *Sisymbrium* is now believed to be primarily restricted to the Old World, with only one species, *S. linifolium* (Nuttall) Nuttall, native to North America. As presently delimited by these authors, *Sisymbrium* includes only about 40, primarily herbaceous, species with long and linear fruits, 3-veined valves, strongly 2-lobed stigmas, yellow flowers, petals well differentiated into blade and claw, and pinnately divided, non-fleshy lower leaves.

Neuontobotrys includes species of subshrubs (rarely perennial herbs) with oblong-linear or short linear fruits, entire stigmas, yellow petals turning reddish in age, leathery fruit valves with a distinct midvein, petals undifferentiated into blade and claw, and undivided fleshy leaves. It also differs from the shrubby South American taxa placed by Schulz (1924, 1936) and Romanczuk (1981, 1982) in *Sisymbrium* and other genera by the strongly recurved or reflexed fruiting pedicels and thick-leathery fruit valves. *Eremodraba* O. E. Schulz resembles *Neuontobotrys* in the orientation of fruiting pedicels and in having short fruits, but this genus consists of glabrous annuals with papery and veinless valves, nonfleshy leaves, and yellow petals not turning red (Al-Shehbaz, 1990).

As cited below, the type of *Neuontobotrys* is *Sisymbrium linifolium* Philippi, but the species epithet is a later homonym of *S. linifolium* (Nuttall) Nuttall (Torrey & Gray, 1838). According to Greuter et al. (2000: Art. 58, p. 88), the species and its date of publication in *Neuontobotrys* should be attributed to Schulz (1924) and the name should be cited as *N. linifolia* Schulz (not as *N. linifolia* (Philippi) Schulz). However, the epithet *linifolia* is illegitimate, and the earliest legitimate epithet is *linearifolia*, a new name proposed by Kuntze (1898) in his transfer of the species to *Hesperis* L., as *H. linearifolia* Kuntze. Therefore, the type species of *Neuontobotrys* should be *N. linearifolia*, and the new combination is proposed below.

KEY TO THE SOUTH AMERICAN SPECIES OF *NEUONTOBOTRYS*

1a. Leaves broadly ovate to narrowly lanceolate, auriculate at base; at least some trichomes branched.
  2a. Leaves entire, narrowly lanceolate, 1–2 mm wide; sepals 3–3.5 mm long; petals 4.5–5 mm long, sparsely pubescent outside; anthers 0.9–1 mm long . . . . . 4. *N. elloanensis*
  2b. Leaves dentate, broadly ovate to ovate-lanceolate, 4–10(–20) mm wide; sepals 4–5.5 mm long; petals 6–8 mm long, glabrous on outside; anthers 1.7–2.7 mm long . . . . . 5. *N. deserticola*

1b. Leaves linear to oblong-linear, not auriculate or rarely minutely auriculate (*N. berningeri*); trichomes exclusively simple or absent.
3a. Fruits (2–)2.8–4.5(–5.5) cm × 2–2.5 mm; seeds 2–2.5 × 1–1.5 mm, distally winged; leaves flat, 3–10(–13) mm wide; sepals 6–9 mm long; petals 10–15 × 3–4 mm; plants glabrous . . . . . 3. *N. robusta*
3b. Fruits 1–2 cm × 1–1.5 mm; seeds 0.6–0.9 × 0.4–0.5 mm, wingless; leaves subterete, 1–1.5 mm wide; sepals 3–4 mm long; petals 4–7 × 0.8–1.2 mm; plants pilose with simple trichomes.
4a. Raceme 10- to 20-flowered; style slender, 1–2.5 mm long; stigma narrower than style; petals 4–5.5 mm long; leaves not auriculate . . . . . 1. *N. linearifolia*
4b. Raceme 20- to 40-flowered; style stout, to 1 mm long; stigma distinctly wider than style; petals ca. 7 mm long; coarser leaves minutely auriculate . . . . . 2. *N. berningeri*

1. Neuontobotrys linearifolia (Kuntze) Al-Shehbaz, comb. nov. Basionym: *Hesperis linearifolia* Kuntze, Revis. Gen. Pl. 3(2): 6. 1898. Based on *Sisymbrium linifolium* Philippi, Anal. Mus. Nac. Chile, sect. 2 Bot. 8: 2. 1891, non (Nuttall) Nuttall in Torrey & A. Gray, Fl. N. Amer. 1: 91. 1838. *Neuontobotrys linifolia* O. E. Schulz, Pflanzenreich IV. 105(Heft 86): 176. 1924. TYPE. Chile. Tarapacá [Región I]: Cuesta de Jaiña, en los limites del valle Pampa del Tamarugal, 17 Mar. 1885, *C. Rahmer s.n.* (lectotype, designated here, SGO-49250; isotype, SGO-63214).

Distribution. Endemic to Chile (Región I).

Representative specimens. CHILE. **Región I (Tarapacá):** Dept. Tarapacá, Cord. Quebrada de Quipisca, Noasa, *Werdermann 1115* (B, BM, CAS, E, F, GH, K, MO, UC).

Kuntze (1898) indicated that the species, as *Hesperis linearifolia*, occurs in Argentina (Cerro Morro), but I have not yet seen any material of it from that country. See earlier discussion on the basionym of this species.

2. Neuontobotrys berningeri O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 11: 392. 1932. TYPE: Chile. Pachia-Aico, 15 Apr. 1927, *C. Troll 3327* (lectotype, designated here, B; isotypes, B, M).

Distribution. Endemic to Chile (Región I).

Schulz (1932) cited three syntypes under this species, of which two, not housed at B (*Berninger 370, 397*) and whose whereabouts are unknown to me, were not available for this study. One of the two sheets of *Troll 3327* at B includes a complete plant, line drawings of floral parts, and annotation of the species name with Otto Schulz's handwriting. This sheet is taken as the lectotype.

3. Neuontobotrys robusta (Chodat & Wilczek) Al-Shehbaz, comb. nov. Basionym: *Sisymbrium robustum* Chodat & Wilczek, Bull. Herb. Boissier, ser. 2, 2: 290. 1902. TYPE: Argentina. Mendoza: Vallée du Rio Atuel, 2000–2100 m, Jan.–Feb. 1897, *E. Wilczek 450* (holotype, G).

Distribution. Endemic to Argentina (Prov. Mendoza, Neuquén, and San Juan).

Although Chodat and Wilczek (1902) did not cite any collections under *Sisymbrium robustum*, I agree with Boelcke (1961) and Romanczuk (1981, 1982) that the above collection represents the type material. It is the only specimen annotated as such with Chodat's handwriting, and it is deposited at G, where the other Chodat types are housed (Stafleu & Cowan, 1976).

The species is distinctly more robust and with larger flowers and fruits (see key) than the remaining species of *Neuontobotrys*, but the overall generic characters discussed above apply very well to it.

4. Neuontobotrys elloanensis Al-Shehbaz, sp. nov. TYPE: Chile. Región II (Antofagasta): Prov. El Loa, NE of Calama, along the road from near Chiu Chiu to Caspana, ca. 46 km from its turnoff from the Calma–Chiu Chiu road, arid scrubland, 22°20′36″S, 68°15′30″W, 3500 m, 10 Apr. 1994, *C. M. Taylor & A. Pool 11552* (holotype, MO). Figure 1.

Suffrutex 10–17 cm alta, pilis dendriticis; caules multiramosi, superne glabri et glauci. Folia caulina anguste lanceolata, 4–13 × 1–2 mm, carnosa, sessilia, auriculata. Racemi ebracteati, 6–10-flori; pedicelli fructiferi valde reflexi vel semicirculariter recurvati, 3–5 mm longi. Petala initio lutea, mox rubescentia, lineari-oblanceolata, 4.5–5 × 0.5–0.7 mm; ovula 12–14. Fructus oblongo-lineares, 6–8 × ca. 1 mm; stylus 0.8–1 mm longus; semina ovidea, uniseriata, 0.9–1 × 0.6–0.8 mm.

Plants subshrubs, woody at base; trichomes dendritic throughout, 0.1–0.2 mm long; stems 10–17 cm long, erect to ascending, few from base, many-branched above, sparsely pubescent below, glabrous and glaucous above. Leaves all cauline, narrowly lanceolate, 4–13 × 1–2 mm, fleshy, becoming leathery upon drying, moderately pubescent, gradually becoming sparsely pubescent upward, base minutely auriculate, margin entire, apex acute, auricles to 1 × 0.5 mm. Raceme ebracteate, 6- to 10-flowered; fruiting pedicels 3–5 mm long,

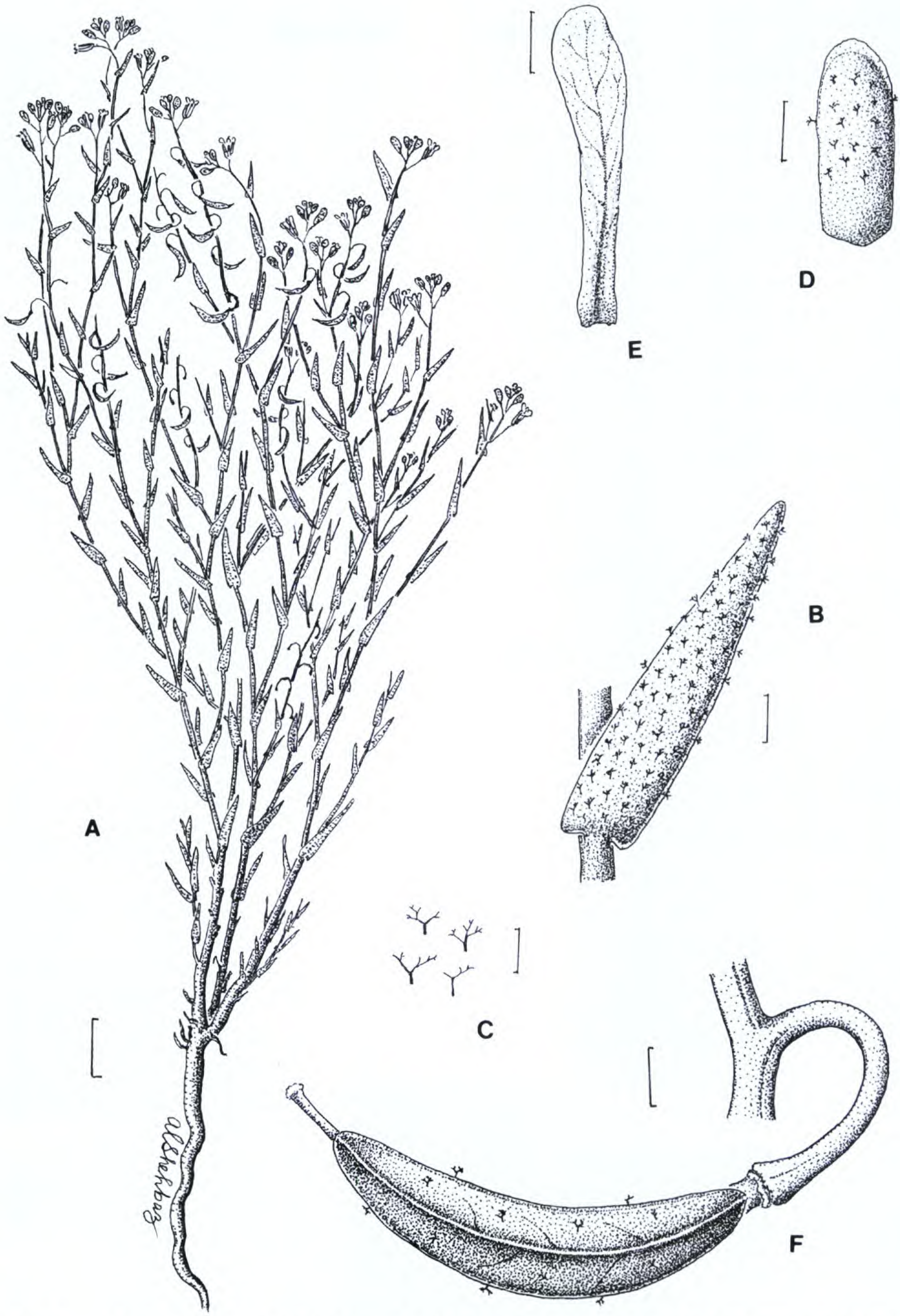

Figure 1. *Neuontobotrys elloanensis* Al-Shehbaz. —A. Plant. —B. Cauline leaf. —C. Trichomes. —D. Sepal. —E. Petal. —F. Fruit and fruiting pedicel. Drawn from the holotype, *Taylor & Pool 11552* (MO). Scale: A = 1 cm, B, D–F = 1 mm, C = 0.1 mm.

glabrous, strongly reflexed or recurved and forming half a loop. Sepals narrowly oblong, 3–3.5 × 0.5–0.7 mm, moderately pubescent; petals yellow, soon turning reddish with age, linear-oblanceolate, 4.5–5 × 0.5–0.7 mm, sparsely pubescent outside; filaments 2.5–3 mm long; anthers oblong-linear, 0.9–1 mm long; ovules 12 to 14 per locule. Fruits oblong-linear, 6–8 × ca. 1 mm, not torulose; valves thick, leathery, with a prominent midvein; gynophore 0.1–0.2 mm long; style slender 0.8–1 mm long; seeds ovoid, brown, uniseriate, 0.9–1 × 0.6–0.8 mm.

Neuontobotrys elloanensis, which is known only from the type gathering, is easily distinguished from its nearest relative, *N. deserticola*, by having entire, narrowly lanceolate leaves to 2 mm wide and smaller petals (4.5–5 mm long) sparsely pubescent outside. By contrast, *N. deserticola* has dentate, broadly ovate to ovate-lanceolate leaves 4–10(–20) mm wide and larger petals (6–8 mm long) glabrous outside.

5. Neuontobotrys deserticola (Philippi) Al-Shehbaz, comb. nov. Basionym: *Cardamine deserticola* Philippi, Anal. Univ. Chile 81: 86. 1892. TYPE: Chile. "Deserto Atacama ad fontem Acerillos," Oct. 1877, *O. Villanueva 1606* (holotype, SGO-63889).

Sisymbrium philippianum I. M. Johnston, Rev. Chil. Hist. Nat. 33: 26. 1929. Syn. nov. Based on *Sisymbrium amplexicaule* Philippi, Fl. Atac. 8: 10. 1860, non A. Gray, U.S. Explor. Exped. Wilkes, Bot. XV. 61. 1854. TYPE: Chile. Atacama: Pajonal, [23°46′S, 3170 m], *R. A. Philippi s.n.* (lectotype, designated here, SGO-49243).

Distribution. Argentina (Prov. Catamarca, Jujuy, and Salta), Bolivia (Depto. Potosí), and Chile (Región II and III).

Representative specimens. ARGENTINA. **Catamarca:** Antofagasta de la Sierra, Los Nacimientos, *Cabrera et al. 31862* (MO). **Jujuy:** Susquesientre Cauchori y Catua, *Cabrera et al. 22544* (SI). **Salta:** Salar de Gallego, Camino a Luca-huasi, *Cabrera 8882* (F, GH). BOLIVIA. **Potosí:** Prov. Nor Lipes, Chiguana, *Asplund 3031* (S, UPS). CHILE. **Región II (Antofagasta):** San Pedro, near river Loa, *Zöllner 8842* (MO, US). **Región III (Atacama):** Depto. Copiapó, Cord. Rio Figueroa, Cl. Paredones, *Werdermann 968* (B, CAS, F, GH, MO, UC).

Although the type of *Neuontobotrys deserticola* consists of three racemes and lacks the lower parts of the plant, it is indistinguishable in every aspect of flower, fruit, and indumentum from plants of *Sisymbrium amplexicaule* Philippi. In fact, Schulz (1924) was the first to point out this similarity but failed to unite the two species.

Muñoz-Pizarro (1960) cited two sheets, SGO-49242 and SGO-49243, as the type of *Sisymbrium amplexicaule*. The latter specimen, which is the most complete and consists of four plants all collected from one locality, is designated herein as the lectotype. The other sheet, SGO-49242, has five fragments each collected from a different place, and it is impossible to assign any of these fragments to a given locality.

As delimited by Kuntze (1898), *Hesperis intricatissima* (Philippi) Kuntze included two species that differ substantially in every morphological aspect except for fruit size and orientation. In order to simplify the complicated nomenclature of these two species, they are designated herein as "sp. A" and "sp. B." One species (sp. A), which is the basionym of *H. intricatissima*, is a glabrous annual originally described as *Draba intricatissima* Philippi and now recognized as *Eremodraba intricatissima* (Philippi) O. E. Schulz (Schulz, 1924; Al-Shehbaz, 1990). The second of Kuntze's (1898) species (sp. B) is a pubescent perennial or subshrub corresponding to *Sisymbrium amplexicaule* Philippi. Schulz (1924) mishandled the nomenclature of Kuntze's (1898) *H. intricatissima* in four ways. First, he excluded the material based on sp. A to *Eremodraba*, but maintained the epithet "*intricatissima*" in *Sisymbrium* for sp. B. Second, he called the species *Hesperis intricatissima* Kuntze, instead of *H. intricatissima* (Philippi) Kuntze, even though Kuntze (1898) cited the basionym *D. intricatissima* and did not treat the plant as a new species. Third, Schulz (1924, 1928, 1932) overlooked Reiche's (1896) earlier transfer of *D. intricatissima* (sp. A) to *Sisymbrium*. Finally, although Johnston (1929) correctly interpreted the nomenclature of sp. B and proposed the name *S. philippianum* I. M. Johnston to replace the later homonym *S. amplexicaule* Philippi, Schulz (1932) continued to use *S. intricatissimum* for sp. B and placed *S. philippianum* in its synonymy.

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A Synopsis of the South American *Weberbauera* (Brassicaceae)

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ABSTRACT. Twenty-two species are recognized in *Weberbauera* (Brassicaceae), and a key to distinguish them is given. *Weberbauera dillonii*, *W. scabrifolia*, and *W. violacea* are described and illustrated, and their distinguishing characters from nearest relatives are discussed. The new combinations *W. peruviana* and *W. lechleri* are proposed. *Sisymbrium petraeum* and *S. fastigiatum* are reduced to synonymy of *W. lechleri*.

RESUMEN. Se reconocen veintidos especies en *Weberbauera* (Brassicaceae), y se presenta una clave para distinguirlas. Se describen e ilustran *Weberbauera dillonii*, *W. scabrifolia* y *W. violacea* y se discuten los caracteres que las distinguen de otras especies cercanas. Se proponen nuevas combinaciones de *W. peruviana* y *W. lechleri*. Los nombres *Sisymbrium petraeum* y *S. fastigiatum* se reducen a sinónimos de *W. lechleri*.

Key words: Brassicaceae, *Sisymbrium*, South America, *Stenodraba*, *Weberbauera*.

Weberbauera O. E. Schulz (Brassicaceae), a genus widely distributed in Peru, Bolivia, Argentina, and Chile (Appel & Al-Shehbaz, 2003), was recently revised and its boundaries critically delimited (Al-Shehbaz, 1990a, 1990b). The present paper continues this revision, recognizing 22 species in *Weberbauera*, including three new species and two new combinations. The two names transferred herein to *Weberbauera*, *W. peruviana* (DC.) Al-Shehbaz and *W. lechleri* (Fournier) Al-Shehbaz, were originally described in *Sisymbrium* L.

Sisymbrium was believed to have one of its major centers of diversity in South America (Schulz, 1924; Al-Shehbaz, 1988), but that opinion has been shown to be incorrect (Warwick et al., 2002), and the genus is considered to be restricted primarily to the Old World, with only one species, *S. linifolium* Nuttall, native to the New World (western North America). Ravenna (1981) and Boelcke and Romanczuk (1984) placed in *Stenodraba* O. E. Schulz some species recognized here as *Weberbauera*. Schulz (1924, 1936) separated *Stenodraba* from *Weberbauera* solely on the absence instead of the presence of bracts. This is an unreliable feature for the delimitation of genera in Brassicaceae, and numerous other genera (e.g., *Cardamine* L., *Draba* L., *Rorippa* Scopoli, *Sisymbrium*) have species with or without bracts (Appel & Al-Shehbaz, 2003). As indicated by Al-Shehbaz (1990a), *Stenodraba* does not merit recognition.

In the enumeration below, the information provided includes the bibliographic citation of each species and its type collections. If the species is known from collections other than the type, one representative collection for every major locale is cited. For the full synonymy and typification of species 2, 3, 7, 8, 10, 12, 18–21, see Al-Shehbaz (1990a). For a detailed description of *Weberbauera* and full account of its generic synonyms and their types, see Al-Shehbaz (1990a).

Weberbauera Gilg & Muschler, Bot. Jahrb. Syst. 42: 481. 1909. TYPE: *Weberbauera densiflora* (Muschler) Gilg & Muschler = *Weberbauera spathulifolia* (A. Gray) O. E. Schulz.

KEY TO THE SPECIES OF *WEBERBAUERA*

1a. Plant, including fruit, densely covered with malpighiaceous trichomes; petals often pubescent . . . . . 21. *W. trichocarpa*

1b. Plants glabrous or with simple and/or stalked forked trichomes, rarely with malpighiaceous trichomes and then only on basal leaves; fruit glabrous or rarely sparsely pubescent with simple trichomes; petals glabrous.

2a. Inflorescence bracteate throughout, rarely uppermost flowers ebracteate.

3a. Petals violet, 6.5–7.5 × 3–3.5 mm . . . . . 22. *W. violacea*

3b. Petals white, 2–3.5(–5) × 0.7–2(–2.5) mm.

4a. Plants densely scabrous with appressed antrorse trichomes; basal leaves entire, densely scabrous adaxially, glabrous abaxially . . . . . 16. *W. scabrifolia*

4b. Plants glabrous or pilose with spreading trichomes; at least some leaves dentate, repand, lyrate, or pinnatifid, all glabrous or pubescent but never scabrous.

5a. Basal leaves not ciliate at base, sometimes glabrous or with forked trichomes . . . . . 18. *W. spathulifolia*

5b. Basal leaves conspicuously ciliate (at least basally) or densely covered with simple trichomes.

6a. Fruit apex attenuate; style 1–3 mm long; petals 3.5–5 mm long . . . 7. *W. herzogii*

6b. Fruit apex obtuse; style to 0.2 mm long; petals 2.5–3.5 mm long.

7a. Basal and lowermost cauline leaves lyrate-pinnatifid, ciliate; stems and leaves glabrous; cauline leaves and bracts entire or repand; seeds 3 to 5 per locule . . . . . 1. *W. bracteata*

7b. Basal and lowermost cauline leaves denticulate or dentate, not ciliate; stems and leaves densely pilose or hirsute; cauline leaves and bracts coarsely dentate; seeds 6 to 15 per locule.

8a. Cauline leaves and bracts sessile; stems retrorsely pilose; fruits glabrous; pedicels pilose; petals 2–2.5 mm wide . . . . . 6. *W. dillonii*

8b. Cauline leaves and bracts petiolate; stems hirsute; fruits hirsute; pedicels glabrous; petals 0.7–1 mm wide . . . . . 14. *W. peruviana*

2b. Inflorescences ebracteate, rarely lowermost few flowers bracteate.

9a. Sepals persistent into fruit; fruit sparsely pubescent with retrorse simple trichomes . . . . . 15. *W. retropilosa*

9b. Sepals soon caducous; fruit glabrous.

10a. Petals yellow; fruit septum perforate; leaves adaxially densely sericeous . . . . 13. *W. perforata*

10b. Petals white; fruit septum complete; leaves glabrous or differently pubescent.

11a. Basal leaves numerous; petioles persistent, straw-colored, 3–3.5 cm long, ca. as long as blade, overlapping and forming a dense crown . . . . . 5. *W. densifolia*

11b. Basal leaves few to several; petioles soon caducous or if persistent, then not straw-colored, less than 3 cm long, shorter than blades, not forming a dense crown.

12a. Stems several-branched above; plants with some dendritic trichomes at least on stems and sepals.

13a. Basal leaves ciliate with simple trichomes, pubescent with dendritic trichomes . . . . . 12. *W. parvifolia*

13b. Basal leaves not ciliate, exclusively with malpighiaceous trichomes . . . . . 10. *W. lechleri*

12b. Stems simple above; plants glabrous or with simple and/or forked trichomes.

14a. Basal and cauline leaves not ciliate, sometimes glabrous or with some branched trichomes.

15a. Leaves fleshy, glabrous; petals 6.5–8 mm long; caudex thick, 1.5–2 cm diam. . . . . 17. *W. smithii*

15b. Leaves not fleshy, often pubescent or rarely glabrous; petals 2–3.5 (–4) mm long; caudex slender, almost always less than 1 cm diam.

16a. Basal leaves filiform to narrowly linear; cauline leaves coarsely dentate-serrate; trichomes minute, 0.03–0.1(–0.15) mm long . . . . . 11. *W. minutipila*

16b. Basal leaves oblong, ovate, lanceolate, or spatulate, very rarely linear; cauline leaves entire to repand or dentate; trichomes coarser, (0.2–)0.4–0.7(–1.1) mm long . . . . . 18. *W. spathulifolia*

14b. Basal and cauline leaves ciliate with simple trichomes.

17a. Basal leaves pinnatifid; inflorescence 1- to 3-flowered; petals less than 2 mm long; stems less than 2 cm tall . . . . . 4. *W. cymosa*

17b. Basal leaves entire, rarely dentate or sinuate; inflorescence (3- or)4- to 10(to 15)-flowered; petals 2–5.5 mm long; stems more than 2 cm tall.

18a. Basal leaves semiterete, thick, linear . . . . . 20. *W. suffruticosa*

18b. Basal leaves flat, thin, oblong to oblanceolate or spatulate, rarely linear-lanceolate.

19a. Style obsolete or rarely to 0.6 mm long in fruit.

20a. Fruit torulose; infructescence lax racemes; fruiting pedicel slender, divaricate, 4–8(–12) mm long; basal leaves entire, to 1.5 mm wide . . . . . 9. *W. lagunae*

20b. Fruit smooth; infructescence usually dense, subumbellate; fruiting pedicels stout, subappressed, 1.5–4.5(–7) mm long; basal leaves usually dentate, 2–4.5(–6) mm wide . . . . . 3. *W. colchaguensis*

19b. Style 1–3 mm long in fruit, if shorter then fruits conspicuously flattened.

21a. Leaves abaxially with trichomes shorter than those adaxially or on margin; fruit torulose; stems usually leafless; petioles of basal leaves stout, swollen . . . . . 8. *W. imbricatifolia*

21b. Leaves abaxially glabrous; fruit smooth; stems 1- to 4-leaved; petioles of basal leaves slender, not swollen.

22a. Basal leaves entire; petals (3.5–)4–5 mm long; style (0.8–)1.5–2 mm long in fruit . . . . . 19. *W. stenophylla*

22b. Basal leaves dentate; petals 2.5–3.5 mm long; style 0.5–0.9(–1.1) mm long in fruit. . . . . 2. *W. chillanensis*

1. Weberbauera bracteata (O. E. Schulz) J. F. Macbride, Candollea 5: 356. 1934. *Pelagatia bracteata* O. E. Schulz, Pflanzenreich IV. 105(Heft 86): 192. 1924. TYPE: Peru. Ancash: Pallasca, Cordillera of Pelagatos, 4600 m, 23 Jan. 1920, *A. Weberbauer 7234* (holotype, B; isotypes, F, G).

Distribution. Known only from the type collection.

2. Weberbauera chillanensis (Philippi) Al-Shehbaz, J. Arnold Arbor. 71: 244. 1990. *Draba chillanensis* Philippi, Anal. Univ. Chile 2: 377. 1862. TYPE: Chile. [Región IX] Termas de Chillán, s.d., *Philippi s.n.* (holotype, SGO).

Distribution. Argentina (Prov. Mendoza) and Chile (Región VIII and IX).

Representative specimens. ARGENTINA. **Mendoza:** Malargüe, Baños del Azufre, 19 Jan. 1941, *Castellanos s.n.* (BA). CHILE. **Región VIII:** Volcán Peteroa, *Werdermann 604* (B, BM, E, F, G, GH, K, M, MO, NY, S, U, UC, Z). **Región IX:** Ñuble, Cordillera de Chillán, *Jaffuel 3722* (GH).

3. Weberbauera colchaguensis (Barnéoud) Al-Shehbaz, J. Arnold Arbor. 71: 241. 1990. *Cardamine colchaguensis* Barnéoud, in Gay, Fl. Chile 1: 115. 1846. TYPE: Chile. [Región VII] Colchagua, Cordillera del Cajón del Azufre, cerca de volcán de Talcarégue, 8000–9000 ft. [2438–2743 m], s.d., *C. Gay 171* (holotype, P; isotype, G).

Distribution. Argentina (Prov. Mendoza, Neuquén, and Río Negro) and Chile (Región IV, Metropolitana, VII, VIII, X, XI, and XII).

Representative specimens. ARGENTINA. **Mendoza:** Laguna Atuel, *Böcher, Hjerting & Rahn 1976* (C, MO). **Neuquén:** Los Lagos, Filo Machete al Co. Rothleugal, *Dierre 929* (LIL). **Río Negro:** Cordón del Río Colorado, Cerro Gorra, 19 Feb. 1940, *Moreau s.n.* (BA). CHILE. **Región IV:** Choapa, La Vega Redonda, E of La Vega Escondida, *Morrison 16995* (DS, G, K, MO, S, UC). **Región Metropolitana:** Rio Blancos, *Frödin 580* (UPS). **Región VII:** Colchaqua, Las Damas, *Philippi 91b* (SGO). **Región VIII:** Curicó, El Valle de los Ciegos, near volcano of Peteroa, *Bridges 1120* (BM, E). **Región X:** Cautín, Villarrica, *Neger s.n.* (M). **Región XI:** Osorno, Paso Puyehue, *Sparre & Constance 10812* (UC). **Región XII:** Cerro Agudo, 50°49′S, 72°57′W, *Arroyo & Squeo 870017* (CONC).

4. Weberbauera cymosa Al-Shehbaz, J. Arnold Arbor. 71: 239. 1990. TYPE: Bolivia. La Paz: Murillo, near Palca, base of Illimani, 4800–5000 m, 25 Feb. 1979, *A. Ceballos, A. Chapin, J. Fernández-Casas & E. Valdéz-bermeijo 543* (holotype, G).

Distribution. Endemic to Bolivia (Depto. La Paz).

Representative specimens. BOLIVIA. **La Paz:** Murillo, La Paz-El Alto-Valle de Zongo, 16°17′S, 68°7′W, *Beck 21752* (LPB, MO).

The species is known thus far only from the two collections cited above.

5. Weberbauera densifolia Al-Shehbaz, J. Arnold Arbor. 71: 229. 1990. TYPE: Argentina. Prov. Catamarca: Depto. Santa María, Sierra del Aconquija, 4600 m, 20 Feb. 1925, *S. Venturi 6610* (holotype, US).

Distribution. Argentina (Prov. Catamarca) and Bolivia.

Representative specimens. ARGENTINA. **Catamarca:** Catamarca, *Rodriguez 1360* (MO). BOLIVIA. Without locality, *Navarro Sánchez 1147* (MO).

The species is known thus far only from the three collections cited above.

6. Weberbauera dillonii Al-Shehbaz, sp. nov. TYPE: Peru. La Libertad: Bolívar, Ascenso Nevado de Cajamarquilla, 3000 m, 7°08′S, 77°42′W, 10 Nov. 2001, *I. Sánchez V., M. Dillon & G. Iberico 11172* (holotype, MO; isotypes not seen, CPUN, F). Figure 1.

Herba perennis retrorse pilosa, 15–25 cm alta. Folia basalia rosulata, petiolata, oblonga vel oblanceolata, 2–6 × 0.7–1.5 cm, denticulata, retrorse pilosa; folia caulina sessilia, oblonga vel ovata, grosse dentata. Racemi 20–50-flori, omnino bracteati; pedicelli fructiferi 4.5–6.5 mm longi, sigmoidei vel recurvati, retrorse pilosi. Sepala oblonga, 2.5–3 × 0.7–1 mm; petala alba, late obovata, 3–3.5 × 2–2.5 mm. Fructus lineares vel oblongo-lineares, 8–12 × 1.5–2 mm, glabri, curvati; stylus 0.1–0.2 mm longus; semina oblonga, 1–1.3 × 0.6–0.7 mm; cotyledones incumbentes.

Perennial herbs, retrorsely pilose throughout except for petals and fruits; caudex with petiolar remains of previous years; trichomes simple, retrorse; stems 15–25 cm long, erect or ascending, densely pilose with appressed retrorse trichomes, usually a few from the base, simple or branched above, densely pilose with appressed retrorse trichomes. Basal leaves rosulate; petiole 1–3 cm long, pubescent as stems; leaf blade oblong to oblanceolate, 2–6 × 0.7–1.5 cm, densely and retrorsely pilose on both sides, base cuneate to attenuate, margin denticulate, apex subacute; middle cauline leaves sessile, oblong to ovate, 1–2 cm × 4–8 mm, base cuneate, margin coarsely dentate, apex acute, pubescent as basal leaves. Raceme 20- to 50-flowered, bracteate throughout, dense, slightly elongated in fruit; bracts sessile, cuneate to subauriculate at base, similar to cauline leaves but progressively smaller upward; fruiting pedicels 4.5–6.5 mm long, sigmoid and slightly recurved, retrorsely pubescent. Sepals oblong, 2.5–3 × 0.7–1 mm, not saccate at base, sparsely pubescent below apex, ascending; petals white, broadly obovate, 3–3.5 × 2–2.5 mm, not clawed, apex rounded; filaments 2–2.5 mm long; anthers oblong, ca. 0.5 mm long. Fruits linear to oblong-linear, 8–12 × 1.5–2 mm, glabrous, curved, slightly flattened at a right angle to the septum; valves smooth, not veined; septum complete; style 0.1–0.2 mm long; stigma entire; seeds 8 to 10 per locule, oblong, brown, 1–1.3 × 0.6–0.7 mm; funicles slender along entire length; cotyledons incumbent.

Weberbauera dillonii, which is known only from the type collections, is named in honor of Michael Dillon, one of the collectors of the type material who has done extensive fieldwork in Peru. It belongs to a group of four other species with fully bracteate racemes. It is most closely related to *W. peruviana*, from which it is easily distinguished by having sessile cauline leaves and bracts, retrorsely pilose stems and leaves, glabrous fruits, pilose fruiting pedicels, and broadly obovate petals 2–2.5 mm wide. *Weberbauera peruviana* has petiolate cauline leaves and bracts, hirsute stems and leaves, sparsely to densely hirsute fruits, glabrous fruiting pedicels, and narrowly spatulate petals 0.7–1 mm wide.

The new species resembles (in its small petals < 4 mm long, minute styles to 0.2 mm long, and bracteate racemes) *Weberbauera bracteata* (O. E. Schulz) J. F. Macbride, a species known only from the type collection made by August Weberbauer on January 1920 from Depto. Ancash and which has not yet been re-collected. From this, *W. dillonii* is distinguished by having densely and retrorsely pilose stems and leaves, denticulate and non-ciliate basal leaves, coarsely dentate cauline leaves and bracts, broadly obovate petals 2–2.5 mm wide, sigmoid and slightly recurved fruiting pedicels, linear to oblong-linear and curved fruits, veinless valves, and eight to ten seeds per locule. By contrast, *W. bracteata* has glabrous stems and leaves, lyrate-pinnatifid and ciliate basal and lowermost cauline leaves, entire or repand cauline leaves and bracts, spatulate petals ca. 1 mm wide, ascending fruiting pedicels subappressed at base to rachis, oblong and straight fruits, prominently veined valves, and three to five seeds per locule.

From the other two Peruvian species of *Weberbauera* with fully bracteate racemes, *W. spathulifolia* (A. Gray) O. E. Schulz and *W. herzogii* (O. E. Schulz) Al-Shehbaz, *W. dillonii* is separated by having stems and leaves densely and retrorsely pilose (instead of glabrous or sparsely pubescent with spreading trichomes) and funicles slender along the entire length (instead of distinctly flattened at base). From *W. spathulifolia* it is also separated by having exclusively simple instead of forked and submalpighiaceous trichomes mixed with simple ones, and from *W. herzogii* it differs by the minute style 0.1–0.2 mm long instead of (0.8–)1.2–2.5 mm long.

7. Weberbauera herzogii (O. E. Schulz) Al-Shehbaz, J. Arnold Arbor. 71: 236. 1990. *Sarcodraba herzogii* O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 10: 563. 1929. TYPE: Bolivia Felsplatten der Hügel über dem Titi-

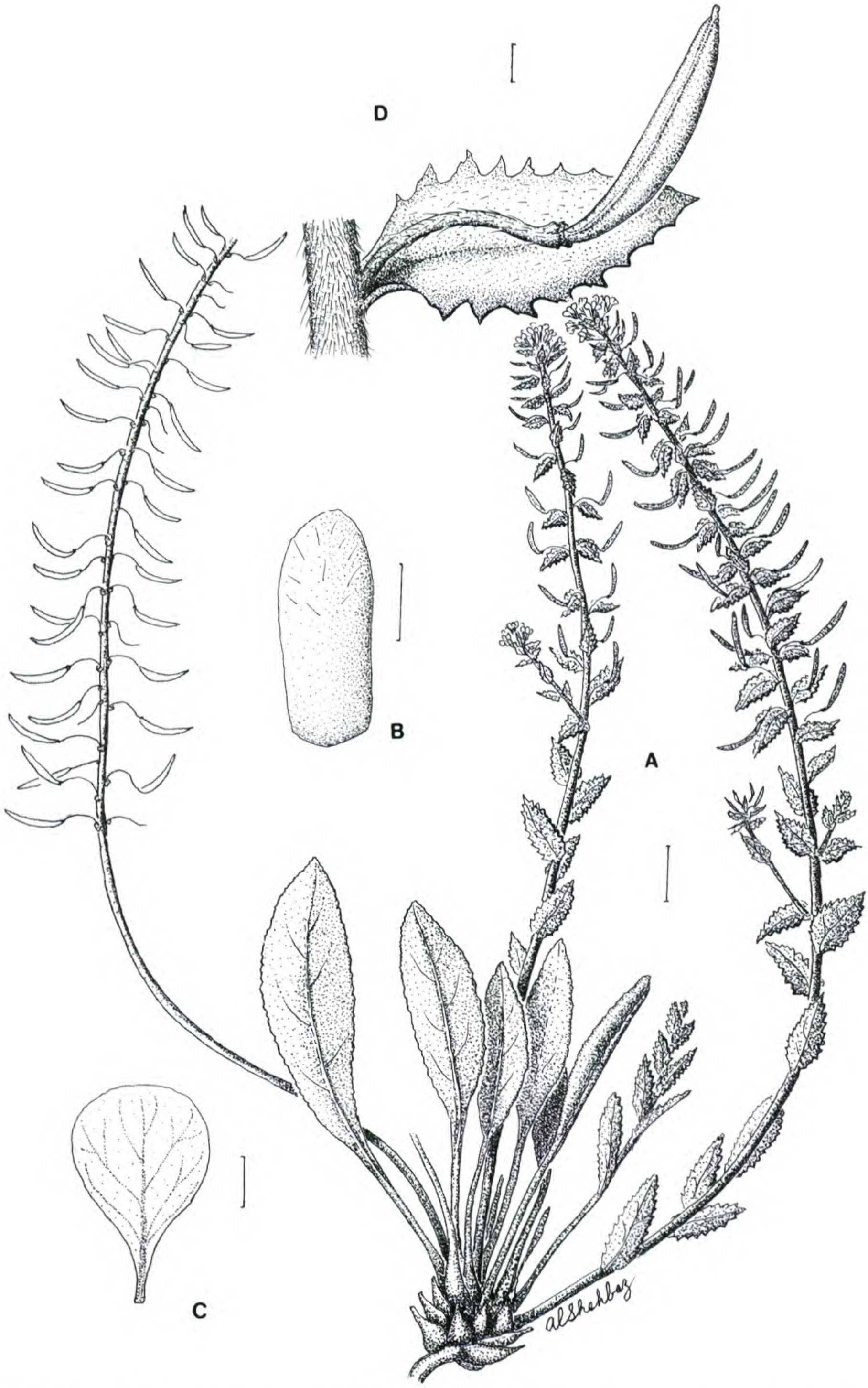

Figure 1. *Weberbauera dillonii* Al-Shehbaz. —A. Plant with remains of infructescence (left) of previous season. —B. Sepal. —C. Petal. —D. Bract, fruiting pedicel, and fruit. Drawn from the MO holotype (*I. Sánchez V., M. Dillon & G. Iberico 11172*) by Al-Shehbaz. Scale: A = 1 cm, B–D = 1 mm.

cacasee bei Guagqui, ca. 3900 m, s.d., *T. Herzog 2510* (holotype, B; isotypes, G, S, Z).

Distribution. Argentina (Prov. Jujuy), Bolivia (Depto. La Paz and Potosí), and Peru (Depto. Puno).

Representative specimens. ARGENTINA. **Jujuy:** Humahuaca, Esquinas blancas, between Tres Cruces and Humahuaca, *Ruthsatz 13/18* (GH). BOLIVIA. **La Paz:** Ingavei, Guaqui, *Asplund 2226* (S, UPS). **Potosí:** Frias, ca. 25 km N of Yocalla towards Ventanilla, *Wood 11743* (K, MO). PERU. **Puno:** Puno, *Shepard 38* (GH, US).

8. Weberbauera imbricatifolia (Barnéoud) Al-Shehbaz, J. Arnold Arbor. 71: 247. 1990. *Draba imbricatifolia* Barnéoud, in Gay, Fl. Chile 1: 158. 1846. TYPE: Chile. [Región IV] Cordillera de Coquimbo, 12,000 ft. [3658 m], *C. Gay s.n.* (holotype, P; isotype, B).

Distribution. Argentina (Prov. San Juan) and Chile (Región IV, V, and VI).

Representative specimens. ARGENTINA. **San Juan:** Dept. Iglesia, 31 km W of Arrequintin, 15 Feb. 1985, *Hunziberg & Gamerro s.n.* (OS). CHILE. **Región IV:** Coquimbo, Cordillera de Combarbalá, Laguna Tibia, 31°17′S, 70°45′W, *Jiles 4864* (CONC, M). **Región V:** Petorca, 5 km S of Junta de Piuquenes, Río Sobrante, *Morrison 17290* (DS, K, UC). **Región VI:** Santiago, Andes of San José, *Gay 1028* (SGO).

9. Weberbauera lagunae (O. E. Schulz) Al-Shehbaz, J. Arnold Arbor. 71: 246. 1990. *Stenodraba suffruticosa* (Barnéoud) O. E. Schulz var. *lagunae* O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 10: 469. 1928. TYPE. Chile. Vallenar, Cordillera Laguna Chica, ca. 4000 m, Jan. 1924, *E. Werdermann 262* (holotype, B; isotypes, BM, CONC, E, F, G, GH, K, MO, UC).

Distribution. Endemic to Chile (Región III).

Representative specimens. CHILE. **Región III:** vicinity of Laguna Valeriano, *Johnston 6065* (CONC, GH, US).

10. Weberbauera lechleri (Fournier) Al-Shehbaz, comb. nov. Basionym: *Sisymbrium lechleri* Fournier, Rech. Crucif. 129. 1865. TYPE: Chile. Terra Pehuenchorum, Dec. 1854, *W. Lechler 3080* (holotype, P; isotypes, G[2], K, P[2]).

Sisymbrium petraeum Philippi, Linnaea 28: 668. 1856, non *S. petraeum* (L.) Delarbre, Fl. Auv. ed. 2: 349. 1800. Syn. nov. *Stenodraba glareosa* Ravenna, Nordic J. Bot. 1: 141. 1981. TYPE: Chile. [Prov. Ñuble] "in Andibus prope oppidum Chillán," *R. A. Philippi s.n.* (holotype, SGO 49254).

Sisymbrium fastigiatum Philippi, Anal. Univ. Chile 41: 670. 1872. Syn. nov. TYPE: Chile. [Prov. Santiago]: Mina Cristo, valley of Maipo, *B. Dávilla s.n.* (lectotype, designated by Muñoz-Schick (1973: 30), SGO 45138).

Distribution. Argentina (Prov. Neuquén and Río Negro) and Chile (Región IX).

Representative specimens. ARGENTINA. **Neuquén:** Cerro Colohuincul, *Comber 876* E (K). **Río Negro:** Bariloche, lago Moreno Este, *Hosseus 107* (BAF). CHILE. **Región IX:** Cordillera of Chillan, 1856–1857, *P. Germain s.n.* (G, K, W).

Muñoz-Schick (1973) designated the above lectotype of *Sisymbrium fastigiatum*, but Ravenna (1981) overlooked that lectotypification and erroneously designated another one of Dávilla's collections (SGO 47168) as the lectotype. Ravenna (1981) treated *S. petraeum* Philippi, *S. lechleri*, *S. caespitosum* Philippi, and *S. fastigiatum* as four independent species that he placed in the genus *Stenodraba* O. E. Schulz, but the alleged differences given by him are trivial and quantitative in nature. All are indistinguishable in every aspect, especially in their trichomes, which are malpighiaceous on the basal leaves and dendritic on the stems, cauline leaves, and sepals. The density of trichomes is quite variable in *Weberbauera lechleri*, and the holotype has malpighiaceous trichomes restricted to the margins of basal leaves, whereas the isotypes have such trichomes on both leaf surfaces. As indicated above, *Stenodraba* does not merit recognition independent of *Weberbauera*.

Schulz (1924) first placed *Weberbauera lechleri* in *Heterothrix* (B. L. Robinson) Rydberg and later (Schulz, 1936) in *Pennellia* Nieuwland, but he used the illegitimate later homonym *Sisymbrium petraeum* Philippi as the basionym for his combinations. As indicated by Al-Shehbaz (1990c) and Rollins (1980), the generic name *Heterothrix* is an illegitimate later homonym for a genus in the Apocynaceae, and the correct name for the mustard genus is *Pennellia*. *Pennellia* differs from *Weberbauera* by having a cup-shaped calyx with purple sepals about as long as the petals. *Weberbauera* has an oblong calyx with green sepals distinctly shorter than the petals.

11. Weberbauera minutipila Al-Shehbaz, J. Arnold Arbor. 71: 231. 1990. TYPE: Peru. Puno: San Román, Puno–Arequipa road at km 112.8, ca. 4 km (air) E of Tinocopalca (km 119.5), ca. 10 km W of road turnoff to Sta. Lucía (at km 101), ca. 4000 m, 12 Jan. 1963, *H. H. & C. M. Iltis with D. & V. Ugent 1455* (holotype, GH; isotype, WIS).

Distribution. Bolivia (Depto. La Paz) and Peru (Depto. Arequipa, Puno).

Representative specimens. BOLIVIA. **La Paz:** Valle Chuquiaguillo, *Asplund 1888* (S, UPS). PERU. **Arequipa:** Arequipa, S of Sta. Lucía on road from Puno to Arequipa, ca. 4–5 km E of Sta. Lucía, *Iltis & Ugent 1415* (WIS).

12. Weberbauera parvifolia (Philippi) Al-Shehbaz, J. Arnold Arbor. 71: 248. 1990. *Sisymbrium parvifolium* Philippi, Linnaea 28: 667. 1856. TYPE: Chile. Cordillera de Linares, s.d., *Germain s.n.* (holotype, SGO).

Distribution. Argentina (Prov. Neuquén) and Chile (Región Metropolitana, VII, and VIII).

Representative specimens. ARGENTINA. **Neuquén:** Cordillera del Viento, cruzada de Tricao, Malal al Cajón de Butaló, *Boelcke et al. 11565* (BAA, SI). CHILE. **Región Metropolitana:** Monumento Natural el Morado, *Price 1409* (MO). **Región VII:** Colchagua, San Fernando, Termas El Falco, *Montero 6043* (SI). **Región VIII:** Curicó, Termas del Flaco (Andes de Colchagua), *Aravena 33349* (G, GH, MO).

13. Weberbauera perforata Al-Shehbaz, Ann. Missouri Bot. Gard. 77: 841. 1990. TYPE: Peru. Cuzco: Nevado Auzangate [as Ausangate], 71°24′W, 13°38′S, 4800 m, 11 May 1957, *R. Hirsch P1255* (holotype, GH).

Distribution. Known only from the type collection.

14. Weberbauera peruviana (DC.) Al-Shehbaz, comb. nov. Basionym: *Sisymbrium peruvianum* DC., Syst. Nat. 2: 477. 1821. TYPE: Peru. *H. Ruiz & J. A. Pavón s.n.* (holotype, BM; isotypes, B, G-DC).

Distribution. Argentina (Prov. Catamarca, Jujuy, and Tucumán), Bolivia (Depto. Chuquisaca, Cochabamba, La Paz, Oruro, and Potosí), and Peru (Depto. Ayacucho, Cuzco, Huancavelica, Lima, Puno, and Tacna).

Representative specimens. ARGENTINA. **Catamarca:** Cerro Overo, *Brücher 95017* (M). **Jujuy:** Humahuaca, Mina Aguilar, 14 km N of Molina de Minera Aguilar, *Hunziker et al. 10568* (SI). **Tucumán:** Tafi, cumbres Calchaquíes, Co. Bayo, 26°43′S, 65°42′W, *Gómez-Sosa & Múlgura 204* (MO, SI). BOLIVIA. **Chuquisaca:** Zudañez, Cordillera de los Sombreros, along Icla and Azurduy road, *Wood & Carretero 16149* (K, MO). **Cochabamba:** Quillacollo, camino Sipe Sipe a Kami, cuenca del valle de Cochabamba, *Beck et al. 18064* (MO). **La Paz:** 47.2 km NE of Peñas on road to Valle Hichucota, *Solomon 4957* (GH, MO). **Oruro:** Sajama, Curahura de Carangas, 10 km SW on backroad, 68°25′W, 17°50′S, *Johns 83-39* (F, LPB, MO). **Potosí:** 10 km S of Potosí, *West 6359* (GH, MO). PERU. **Ayacucho:** Luncanas, Pampa Galeras, *Tovar 6704* (MO). **Cuzco:** Urubamba, Chichero, Cuper, Qoriwayrachina, 72°0′W, 13°25′S, *C. & E. Franquemont 314* (F). **Huancavelica:** Morococha, *Grant 7573* (A, F). **Lima:** Huarochiri, laguna de Tuctucocha, *Cerrate 1866* (GH). **Puno:** Macusani, road from Ollachea to Macusani, 70°30′W, 13°53′S, *M. & K. Weigend 2000/120* (MO). **Tacna:** Tarata, Corillera del Barroso, *Torre et al. 2135* (MO).

As a result of its exclusion from *Sisymbrium* (Warwick et al., 2002) and the discovery herein of its nearest relative, *Weberbauera dillonii*, *S. peruvianum* is appropriately transferred to *Weberbauera* after being recognized in *Sisymbrium* since its discovery more than 180 years ago. In every aspect of morphology (see discussion under *W. dillonii*), the species is at home in *Weberbauera*.

15. Weberbauera retropilosa Al-Shehbaz, J. Arnold Arbor. 71: 234. 1990. TYPE: Bolivia. Depto. La Paz: Prov. Pacajes, Charaña, 4000 m, 2 Mar. 1921, *Asplund s.n.* (holotype, US).

Distribution. Endemic to Bolivia (Depto. La Paz).

Representative specimens. BOLIVIA. **La Paz:** Pacajes, Charaña, *Asplund 2700* (S, UPS).

The species is known thus far only from the two collections above.

16. Weberbauera scabrifolia Al-Shehbaz, sp. nov. TYPE: Peru. Huánuco: Dos de Mayo, road from Pachas to Llata, 4030 m, 9°42′S, 76°47′W, flat puna, 18 Mar. 2001, *M. Weigend, K. Weigend, M. Binder & E. Rodriguez 5220* (holotype, M; isotype, MO). Figure 2.

Herba perennis, 3–6 cm alta. Folia basalia petiolata, oblonga, 7–20 × 3–9 mm, integra, superne antrorse scabra, inferne glabra; folia caulina sessilia, oblanceolata vel linearia, integra. Racemi 10–27-flori, omnino bracteati; pedicelli fructiferi 4–7 mm longi, recti, pubescentes. Sepala oblonga, 2.5–3 × ca. 1 mm; petala alba, spathulata, 3.5–4 × ca. 1.5 mm. Fructus lineares vel oblongo-lineares, 5–9 × ca. 1.5 mm, glabri, curvati; stylus ca. 1 mm longus; semina oblonga, ca. 1 × 0.5 mm; cotyledones incumbentes.

Perennial herbs; caudex slender, with leaf remains of previous years; trichomes simple, appressed, antrorse; stems 2 to 5 from base, unbranched, 3–6 cm long, decumbent or ascending, densely pubescent with appressed, antrorse trichomes to 0.6 mm long and to 0.04 mm wide at base. Basal leaves rosulate; petiole 4–10 mm long, ciliate; leaf blade oblong, 7–20 × 3–9 mm, abaxially glabrous, adaxially scabrous with antrorse, appressed trichomes to 0.4 mm long and to 0.12 mm wide at base, base cuneate, margin entire, apex obtuse; cauline leaves sessile or nearly so, oblanceo-

Figure 2. *Weberbauera scabrifolia* Al-Shehbaz. —A. Plant. —B. Trichomes of adaxial surface of basal leaves. —C. Trichomes of stems and pedicels. —D. Petal. —E. Fruit and fruiting pedicel. —F. Seed and funicle. Drawn from the M holotype (*M. Weigend, K. Weigend, M. Binder & E. Rodriguez 5220*) by Al-Shehbaz. Scale: A = 1 cm, B, C = 0.4 mm, D–F = 1 mm.

late to linear, 5–10 × 1–4 mm, base attenuate, margin entire, upper ones and bracts ciliate and glabrous except midvein, trichomes longer and narrower than those of basal leaves. Raceme 10- to 27-flowered, bracteate throughout, dense, slightly elongated in fruit; bracts sessile, similar to cauline leaves but progressively smaller upward; fruiting pedicels 4–7 mm long, straight, suberect to ascending, antrorsely pubescent. Sepals oblong, 2.5–3 × ca. 1 mm, not saccate at base, sparsely pubescent, ascending; petals white, spatulate, 3.5–4 × ca. 1.5 mm, apex rounded, claw ca. 1.5 mm long; filaments ca. 2.5 mm long; anthers oblong, ca. 0.5 mm long. Fruits linear to oblong-linear, 5–9 × ca. 1.5 mm, glabrous, curved, terete; valves smooth, with a distinct midvein; septum complete; style ca. 1 mm long; stigma entire; seeds 5 to 12 per locule, oblong, brown, ca. 1 × 0.5 mm; funicles thickened at base; cotyledons incumbent.

Weberbauera scabrifolia, which is known only from the type gathering, is easily separated from all species of the genus by its appressed, antrorse, simple trichomes much thicker and shorter on the basal leaves than on the rest of the plant and by having basal leaves glabrous abaxially and densely scabrous adaxially.

17. Weberbauera smithii Al-Shehbaz, J. Arnold Arbor. 71: 233. 1990. TYPE: Peru. Ancash: Yungay, Huascarán National Park, Llanganuco Sector, Quebrada Ancosh at Portachuelo, 77°35′W, 9°03′S, 31 Dec. 1984, *D. N. Smith & K. Godwin 8894* (holotype, MO).

Distribution. Endemic to Peru (Depto. Ancash).

Representative specimen. PERU. **Ancash:** Yungay, Huascarán National Park, Llanganuco Sector, Quebrada Ancosh at Portachuelo, *Smith 11298A* (MO).

The species is known thus far only from the two collections above.

18. Weberbauera spathulifolia (A. Gray) O. E. Schulz, Pflanzenreich IV. 105(Heft 86): 193. 1924. Basionym: *Sisymbrium spathulifolium* A. Gray, U.S. Expl. Exped. Phan. 15(1): 60. 1854. TYPE: Peru. [Junín]: Orbajillo, Wilkes Expedition, *Anonymous s.n.* (holotype, US; isotype, NY).

Distribution. Argentina (Prov. Catamarca, Jujuy, and La Rioja), Bolivia (Depto. La Paz, Oruro, and Potosí), and Peru (Depto. Ancash, Huancavelica, Junín, Moquegua, Pasco, Puno, and Santa Rosa).

Representative specimens. ARGENTINA. **Catamarca:** Río Potrero, *Sleumer 1905* (B). **Jujuy:** Humahuaca, Mina Aguilar, *Sleumer 3402* (LIL). **La Rioja:** Sierra Famatina, Cueva de Pérez, *Hieronymus & Niederlein 376* (B). BOLIVIA. **La Paz:** Larecaja, vicinity of Combaya, *Mandon 914* (BM, G, P, K). **Oruro:** Abaroa, Challepata, *Asplund 3293* (UPS). **Potosí:** Frías, Cerro Potosí, *Petersen & Hjerting 1030* (C, LIL). PERU. **Ancash:** Carhuás, Huascarán National Park, Quebrada Los Cedros, *Smith, Valencia & Minaya 9924* (F, GH, MO). **Huancavelica:** Visco, *Macbride & Featherstone 590* (F, G, NY). **Moquegua:** Moquegua, above Torata, *Weberbauer 7471* (BM, F, G, US). **Pasco:** Cerro, Cerro de Pasco, *Macbride 3065* (CAS, F, US). **Puno:** Carabaya, Antapampa, *Vargas 6837* (F). **Santa Rosa:** Cuzco, *Stafford 512* (BM, K).

19. Weberbauera stenophylla (Leybold) Al-Shehbaz, J. Arnold Arbor. 71: 245. 1990. *Draba stenophylla* Leybold, Anal. Univ. Chile 16: 679. 1859. TYPE: Chile. Cord. Santiago, Cerro Colorado, Mapocho Valley, 6000–7000 ft. [1829–2134 m], s.d., *Leybold s.n.* (lectotype, designated here, the plate accompanying the original publication).

Distribution. Endemic to Chile (Región VIII).

Representative specimens. CHILE: **Región VIII:** El Valle de los Ciegos, near volcano of Petreroa, *Bridges 1121* (BM, E, GH, K).

As indicated by Al-Shehbaz (1990a), no type material of this species has been found, and the well-illustrated plate accompanying the detailed original description of *Draba stenophylla* is designated herein as the lectotype.

20. Weberbauera suffruticosa (Barnéoud) Al-Shehbaz, J. Arnold Arbor. 71: 247. 1990. *Draba suffruticosa* Barnéoud, in Gay, Fl. Chile 1: 157. 1846. TYPE: Chile. Cordillera Ovalle, 12,000 ft. [3658 m], *C. Gay s.n.* (holotype, P; isotype, B).

Distribution. Endemic to Chile (Región IV).

Representative specimen. CHILE. **Región IV:** Quebrada Larga [30°44′S, 70°23′W], *Jiles 3408* (CONC).

21. Weberbauera trichocarpa (Muschler) J. F. Macbride, Candollea 5: 356. 1934. Basionym: *Eudema trichocarpum* Muschler, Bot. Jarhb. Syst. 40: 276. 1908. TYPE: Peru. Above Lima, near Alpamia [Alpamina], 4500 m, 2 Mar. 1904, *A. Weberbauer 5119* (holotype, B).

Distribution. Endemic to Peru (Depto. Ancash, Lima, and Pasco).

Representative specimens. PERU. **Ancash:** Pallasca, Conchucós, *Weberbauer 7229* (B, F, GH). **Lima:** Río Blanco, *Macbride 2990* (F, GH, MO, NY, US). **Pasco:** Cerro de Pasco, *Macbride 3073* (CAS, F, GH, MO, NY, US).

22. Weberbauera violacea Al-Shehbaz, sp. nov.

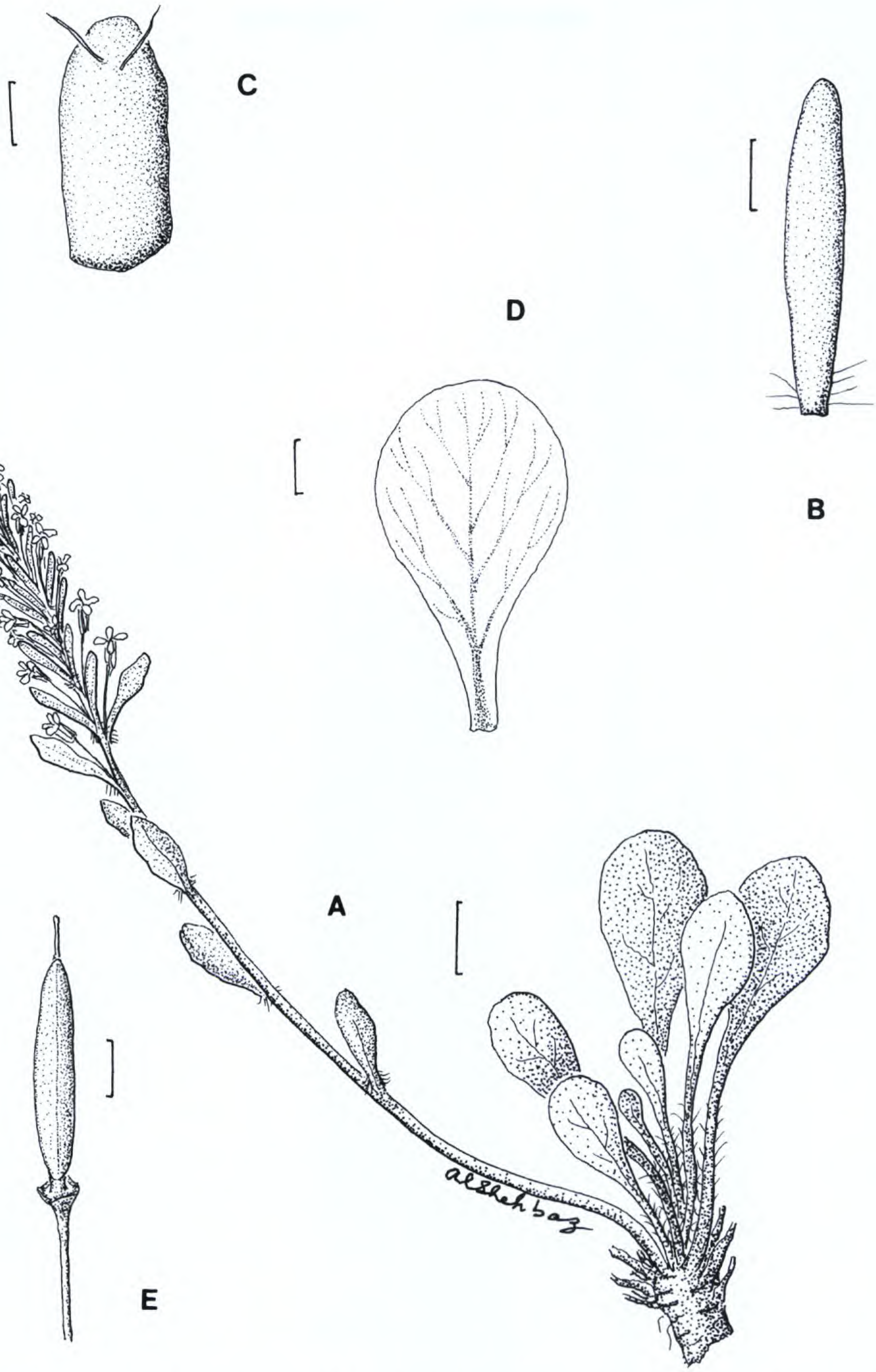

Figure 3. *Weberbauera violacea* Al-Shehbaz. —A. Plant. —B. Bract. —C. Sepal. —D. Petal. —E. Young fruit. Drawn from the MO holotype (*A. Sagástegui A. et al. 11175*) by Al-Shehbaz. Scale: A = 1 cm, B–E = 1 mm.

TYPE: Peru. Cajamarca: Cajabamba, Cajabamba-Luchubamba, jalca vegetation, 3800 m, 17 Nov. 1983, *A. Sagástegui A. et al. 11175* (holotype, MO; isotype, HUT). Figure 3.

Herba perennis, 4–15 cm alta. Folia basalia rosulata, petiolata, spathulata, 1.5–3.5 × 1–2.2 cm, integra vel repanda; folia caulina sessilia, oblonga vel oblanceolata, integra vel repanda, basi ciliata. Racemi 20–35-flori, omnino bracteati; pedicelli floriferi 7–10 mm longi, recti,

subappressi, glabri. Sepala oblonga, 4–5 × 1.5–2 mm; petala violacea, late obovata, 6.5–7.5 × 3–3.5 mm; stylus 1.5–2 mm longus.

Perennial herbs, subglabrous or sparsely pubescent along petiole and at base of cauline leaves; trichomes simple, spreading, to 1.5 mm long; caudex thick, simple; stems 4–15 cm long, decumbent or ascending, unbranched, glabrous. Basal leaves rosulate; petiole 0.5–3.5 cm long, ciliate; leaf blade spatulate, 1.5–3.5 × 1–2.2 cm, glabrous, base cuneate to attenuate, margin entire or repand, apex rounded; cauline leaves sessile, oblong, 6–20 × 1–5 mm, base cuneate, margin entire or repand, apex obtuse, sparsely ciliate at base. Raceme 20- to 35-flowered, bracteate throughout, dense; rachis straight, glabrous; bracts sessile, similar to cauline leaves but progressively smaller upward; flowering pedicels 7–10 mm long, erect to ascending, straight, subappressed, glabrous. Sepals oblong, 4–5 × 1.5–2 mm, not saccate at base, glabrous or with a few trichomes below apex, ascending; petals violet, broadly obovate, 6.5–7.5 × 3–3.5 mm, not clawed, apex rounded; filaments 2–3 mm long; anthers oblong, 0.6–0.8 mm long; style 1.5–2 mm long. Immature fruits linear, ca. 8 × 1 mm; valves glabrous, with a conspicuous midvein; seeds not seen.

Weberbauera violacea, which is known only from the type collection, is readily distinguished from all other species of *Weberbauera* by having violet, large petals 6.5–7.5 mm long and racemes bracteate throughout. All other species of the genus have white or rarely yellow (*W. perforata*) flowers almost always less than 5 mm long. The only exception is *W. smithii*, a species with ebracteate racemes and white flowers 6.5–8 mm long. Petal size and color easily separate the new species from those with fully bracteate racemes (see lead 2a in the key above).

Weberbauera violacea is most closely related to *W. herzogii* and *W. scabrifolia*. All three differ from the remaining species of *Weberbauera* by a combination of fully bracteate racemes, attenuate, slender styles 1–3 mm long, and receptacle considerably wider than the pedicel.

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Transfer of *Arabidopsis gamosepala* and *Torularia brachycarpa* to *Braya* (Brassicaceae)

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ABSTRACT. The new combinations *Braya gamosepala* and *B. brachycarpa* (Brassicaceae) are proposed. The distinguishing characters, especially of habit and fruit and trichome morphology, separating *Arabidopsis*, *Braya*, and *Neotorularia* (formerly *Torularia*) are discussed.

Key words: *Arabidopsis*, Brassicaceae, *Braya*, *Neotorularia*.

Arabidopsis gamosepala Hedge (Brassicaceae), which is endemic to Afghanistan (Hedge, 1968), was transferred to *Neotorularia* Hedge & J. Léonard by Al-Shehbaz and O'Kane (1997) and has been maintained in that genus to the present. It was excluded from *Arabidopsis* Heynhold by these authors because it has pubescent, torulose fruits, and dendritically branched trichomes. As delimited by O'Kane and Al-Shehbaz (1997), Al-Shehbaz et al. (1999), and Al-Shehbaz and O'Kane (2002), *Arabidopsis* has glabrous, non-torulose fruits and a mixture of simple, forked, or rarely stellate stalked trichomes.

Torularia brachycarpa Vassilczenko, originally collected only from Tajikistan (Vassilczenko, 1939), is now documented as widespread in four provinces in China (Zhou et al., 2001). It was transferred to *Neotorularia* (Léonard, 1986) because *Torularia* (Cosson) O. E. Schulz is an illegitimate later homonym of the red algae *Torularia* Bonnemaison.

Recent phylogenetic studies, based on ITS sequences of nuclear ribosomal DNA and *trn*L intron of chloroplast DNA (Warwick et al., 2004), on *Braya* Sterenberg & Hoppe and *Neotorularia* clearly showed that *Arabidopsis gamosepala*, *Neotorularia brachycarpa* (Vassilczenko) Hedge & Léonard, and *B. humilis* (C. A. Meyer) B. L. Robinson (*N. humilis* (C. A. Meyer) Hedge & Léonard) are well nested within *Braya* and are most closely related to species of this genus with linear fruits, including *B. alpina* Sterenberg & Hoppe, the type species of *Braya*. These four species differ from all members of *Neotorularia*, including the generic type *N. torulosa* (Desfontaines) Hedge & Léonard, by being perennials with a well-defined basal rosette (instead of annuals with no basal rosette) and by having at least basally bracteate instead of ebracteate racemes. On the basis of molecular and morphological data, *Arabidopsis gamosepala* and *Neotorularia brachycarpa* are best accommodated in *Braya*, and their transfer to this genus is herein effected.

Braya brachycarpa (Vassilczenko) Al-Shehbaz & Warwick, comb. nov. Basionym: *Torularia brachycarpa* Vassilczenko, in Komarov, Fl. URSS 8: 635. 1939. TYPE: Tajikistan. Pamir: near Ak-baital, confluence of Murgab, ca. 3900 m, 7 July 1901, *M. I. Alexeenko 2391* (holotype, LE).

Braya brachycarpa is easily distinguished from the remaining species of *Braya* by having racemes bracteate throughout or rarely only along the lowermost part, oblong to linear fruits widest basally and 3–10(–15) mm long, and seeds sub-biseriate only at the basal portion of the fruit.

Braya gamosepala (Hedge) Al-Shehbaz & Warwick, comb. nov. Basionym: *Arabidopsis gamosepala* Hedge, in K. H. Rechinger, Flora Iranica 57: 334. 1968. TYPE: Afghanistan. Munjan: above Anjuman valley, near Anjuman, 3100 m, 14 Aug. 1965, *D. Podlech 12379* (holotype, M; isotypes, E, M).

The occurrence of gamosepaly, although rather rare in the Brassicaceae (e.g., *Brayopsis gamosepala* Al-Shehbaz, *Desideria mirabilis* Pampanini, *Sisymbrium gamosepalum* Hedge), is not considered to be a useful character at the generic rank (Al-Shehbaz, 2001), but readily distinguishes *B.*

gamosepala from the remaining species of the genus.

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Shangrilaia (Brassicaceae), a New Genus from China

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ABSTRACT. The new genus and species *Shangrilaia nana* (Brassicaceae) are described and illustrated, and their relationships to distinguishing characters from *Braya* and *Baimashania* are discussed.

Key words: *Baimashania*, Brassicaceae, *Braya*, China, *Shangrilaia*, Yunnan.

Although a comprehensive account of the Brassicaceae for the *Flora of China* has recently been published (Zhou et al., 2001), many new taxa and new nomenclatural adjustments have since been added for China, especially those that are based on plants from Sichuan, Tibet (Xizang), Yunnan, and Xinjiang provinces or autonomous regions (Al-Shehbaz, 2002a, 2002b, 2002c, 2002d, 2003, 2004a, 2004b; Al-Shehbaz & Koch, 2003; Al-Shehbaz & Warwick, 2004; Al-Shehbaz et al., 2002a, 2002b). Such additions clearly indicate that our knowledge of the Chinese mustards, especially from the provinces and regions above, is far from being complete, and further fieldwork is likely to bring additional novelties. A case in point is the present paper, which describes a new genus and species, *Shangrilaia nana*, from Yunnan Province.

Shangrilaia Al-Shehbaz, J. P. Yue & H. Sun, gen. nov. TYPE: *Shangrilaia nana* Al-Shehbaz, J. P. Yue & H. Sun.

Herba nana, perennis, scaposa, pulvinata. Folia aciculari-linearia, ciliata, integra, persistentia, dense imbricata, basi complanata, pilis simplicibus instructa. Flores solitarii. Sepala ovata, nonsaccata. Petala alba, spathulata. Glandulae nectariferae confluentes. Ovula 6–12. Fructus ovoidei, teretes, breviter stipitati, valvis pubescentibus coriaceis; stylus tenuis, ad 1 mm longus; stigma integrum. Semina uniseriata, ovoidea; cotyledones incumbentes.

Dwarf, perennial, scapose, pulvinate herbs, with simple or few-branched caudex covered with leaves of previous years. Trichomes simple. Stems densely leafy, internodes obsolete. Leaves acicular-linear, thick, densely overlapping, ciliate, persistent, with flattened, triangular base. Flowers solitary, terminating stem. Sepals ovate, deciduous, erect, not saccate at base. Petals white, spatulate, obtuse, clawed. Stamens 6, tetradynamous; filaments slender at base; anthers ovate, not apiculate at apex. Nectar glands confluent, subtending bases of all stamens; median glands present. Ovules 6 to 12 per ovary. Fruit dehiscent silicle, ovoid, terete, short stipitate; valves leathery, with a distinct midvein at least basally, pubescent; replum flattened at least basally; septum perforate, veinless; style slender, to 1 mm long; stigma capitate, entire. Seeds uniseriate, wingless, ovoid, not mucilaginous when wetted; cotyledons incumbent.

Initial attempts to identify the plants on which *Shangrilaia* is based, using Zhou et al. (2001), Appel and Al-Shehbaz (2003), or the interactive keys (⟨http://flora.huh.harvard.edu:8080/actkey/index.jsp⟩) to the Brassicaceae genera of the world or that of the flora of China, yielded unsatisfactory results. Those keys inadequately led to either *Baimashania* Al-Shehbaz or *Braya* Sternberg & Hoppe, and the characters of the new genus did not match those of these two genera. It became abundantly clear that a new genus is needed to accommodate them. *Shangrilaia*, which is named after the city Shangri-La (formerly Zhong Dian), differs from both *Baimashania* and *Braya* in having exclusively simple instead of a mixture of simple and branched trichomes, perforate instead of complete septa, and acicular-linear instead of distinctly flattened leaves. It also differs from *Baimashania* in having incumbent instead of accumbent cotyledons, ovoid and terete instead of linear and latiseptate (flattened parallel to the septum) fruits, thick leathery instead of papery valves, veinless instead of veined septum, and flattened instead of rounded replum. From

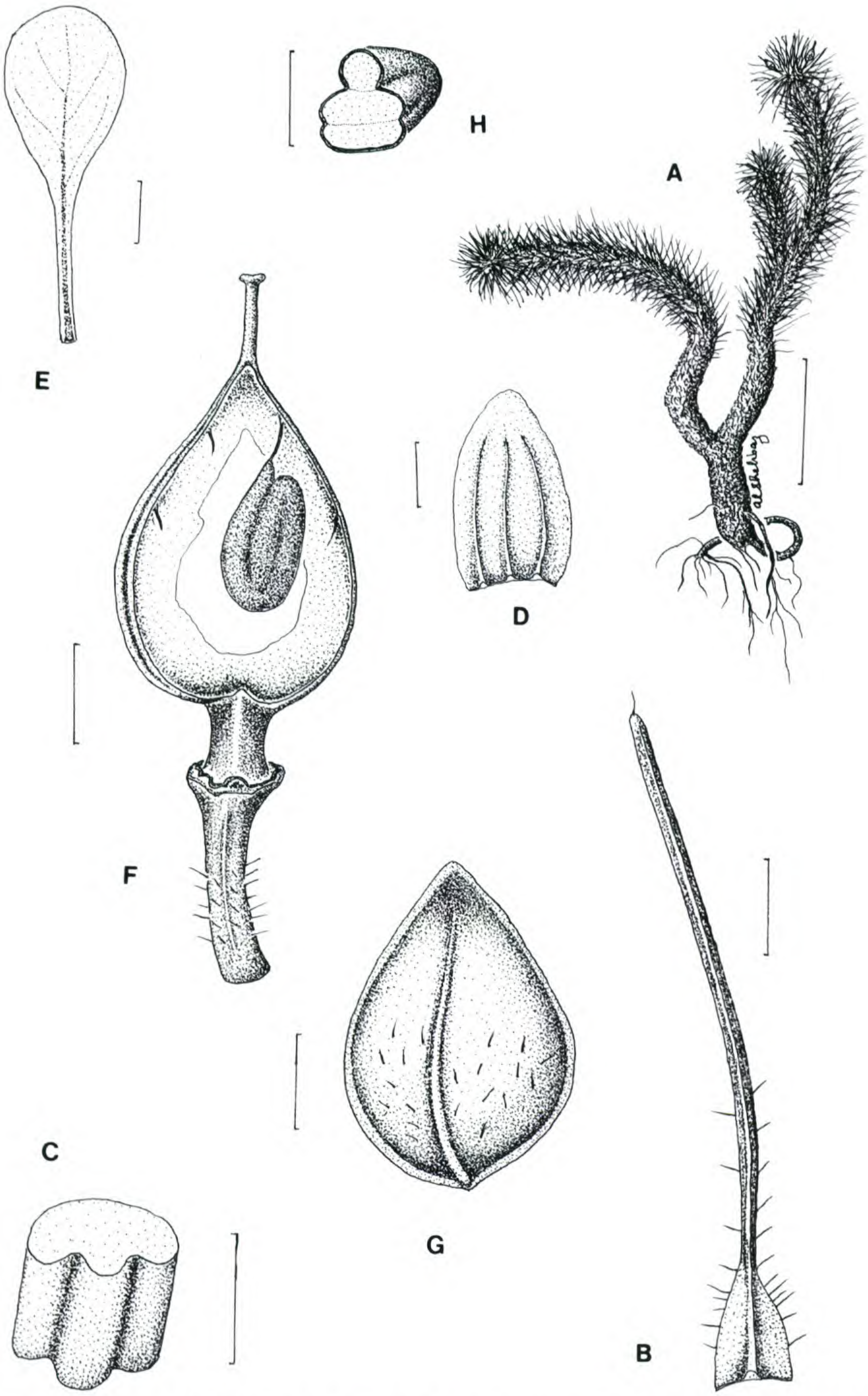

Figure 1. *Shangrilaia nana* Al-Shehbaz, J. P. Yue & H. Sun. —A. Plant. —B. Leaf. —C. Portion of leaf showing abaxial surface. —D. Sepal. —E. Petal. —F. Fruit and pedicel with valve removed to show seed and perforated septum. —G. Fruit valve. —H. Section of seed showing incumbent cotyledons. Scale: A = 1 cm; B, D–G = 1 mm; C = 0.2 mm, H = 0.5 mm. Drawn by Al-Shehbaz from the holotype (*Yue 0366*).

Braya, it is also readily distinguished by having solitary flowers at the end of the stem instead of flowers in racemes or corymbs on a well-developed peduncle, as well as in having confluent instead of four separate nectar glands.

One species assigned to *Braya* by Zhou et al. (2001), *B. forrestii* W. W. Smith, was described as having exclusively simple trichomes. However, molecular studies by Warwick et al. (2004) clearly demonstrated that this species is quite distinct from the rest of *Braya* and perhaps should be excluded from that genus.

Shangrilaia nana Al-Shehbaz, J. P. Yue & H. Sun, sp. nov. TYPE: China. Yunnan: Shi-ka Shan, near Shangri-La, scree slope, sandy area, 27°47′N, 99°35′E, 4200 m, 5 Aug. 2003, *Jipei Yue 0366* (holotype, MO; isotype, KUN). Figure 1.

Herba pulvinata 1–2.5 cm alta, caudice simplici vel pauciramoso. Pili 0.2–0.5 mm longi. Folia aciculari-linearia, 2–6 × 0.2–0.4 mm, dense imbricata, sparse ciliata, basi triangulari, 1–1.5 × 1–1.5 mm. Flores solitarii. Pedicelli fructiferi 0.5–2 mm longi, crassi. Sepala ovata, glabra, 2.5–3 × 1.5–2 mm. Petala alba, spathulata, 4–5 × 1.5–2.5 mm, unguibus 2–3 mm longis. Ovula 6–12. Fructus ovoidei, teretes, breviter stipitati, valvis 3–3.5 × 2–2.5 mm, pubescentibus coriaceis, septis ad maturitatem perforatis; stylus 0.4–1 mm longus. Semina ovoidea, 1–1.2 × 0.6–0.8 mm.

Pulvinate herbs 1–2.5 cm tall, caudex simple or few-branched. Trichomes simple, 0.2–0.5 mm long. Leaves acicular-linear, 2–6 × 0.2–0.4 mm, densely overlapping, with a prominent midvein abaxially; base flattened, subtriangular, 1–1.5 × 1–1.5 mm, margin entire, sparsely ciliate to subsetose at least basally or up to the middle, apex obtuse, often with 1 to 3 trichomes. Flowers solitary, in leaf axils, 1 to 4 terminating the stem. Fruiting pedicels stout, somewhat angled, 0.5–2 mm long, glabrous or sparsely pubescent with straight, horizontal trichomes, distinctly expanded at receptacle. Sepals ovate, glabrous, 2.5–3 × 1.5–2 mm, with prominent veins. Petals white, spatulate, 4–5 × 1.5–2.5 mm, obtuse; claw 2–3 mm long, slender at base. Filaments of median stamens 2–2.5 mm long, those of lateral stamens 1–1.2 mm long; anthers ovate, 0.5–0.6 mm long. Ovules 6 to 12 per ovary. Fruit ovoid, terete; valves leathery, 3–3.5 × 2–2.5 mm, with flat margin and prominent midvein at least basally, puberulent with simple trichomes; septum initially complete, becoming perforate at seed's maturity; gynophore stout, slightly wider than pedicel, 0.2–0.7 mm long; style slender, 0.4–1 mm long. Seeds ovoid, 1–1.2 × 0.6–0.8 mm. Fruiting August–September.

Habitat. Scree slopes on sandy soil; 4180–4200 m. Yunnan.

Both the type collection and the paratype have ample fruits, and the floral description is based on two flowers found on two plants. Collection of flowering material should be done in late June or early July. There is some variation in the pubescence of leaves, and most plants examined have trichomes at the leaf base and usually one or a few at the leaf apex. Although there are up to six ovules in each locule, usually one or two develop into mature seeds. The septum is complete during early fruit development, and fruits with mature seeds always have perforate septa.

Paratypes. CHINA. **Yunnan:** Shika Shan, Zhong Dian, 27°47′N, 99°35′E, 4180 m, 27 Sep. 2001, *J. P. Yue 054* (KUN, MO).

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New Combinations in *Silphium* (Asteraceae: Heliantheae)

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ABSTRACT. As part of a revision of *Silphium* (Asteraceae: Heliantheae) for the *Flora of North America* (FNA), four new combinations are proposed: *S. asteriscus* var. *simpsonii* (Greene) J. A. Clevinger, *S. asteriscus* var. *trifoliatum* (L.) J. A. Clevinger, *S. asteriscus* var. *latifolium* (A. Gray) J. A. Clevinger, and *S. radula* var. *gracile* (A. Gray) J. A. Clevinger. In addition, *Silphium confertifolium* Small is reduced to synonymy of *Silphium asteriscus* var. *latifolium*, and *Silphium simpsonii* var. *wrightii* L. M. Perry is reduced to synonymy of *Silphium radula* Nuttall. *Silphium radula* var. *gracile* is lectotypified.

Key words: Asteraceae, Compositae, Heliantheae, North America, *Silphium*.

As part of a revision of *Silphium* L. (Asteraceae: Heliantheae) in Clevinger's (1999) dissertation, 7000 herbarium specimens from 16 herbaria were examined and populations in 22 states were visited. A molecular phylogenetic study of *Silphium* explored relationships in *Silphium* resulting in the recognition of two monophyletic sections: sect. *Silphium* and sect. *Composita* (Clevinger & Panero, 2000). As a result of these studies and subsequent collecting, four nomenclatural changes in *Silphium* sect. *Silphium* are proposed. Three species names are reduced to varietal rank, and one varietal name is transferred to a different species. These nomenclatural changes pave the way for the taxonomic treatment of *Silphium* that is currently being prepared for the *Flora of North America*.

SILPHIUM ASTERISCUS L.

The most current circumscription of *Silphium asteriscus* can be found in Cronquist (1980). His concept of *Silphium asteriscus* includes three varieties: var. *asteriscus*, var. *angustatum* A. Gray, and var. *scabrum* Nuttall. This taxonomic concept should be expanded to include *S. dentatum* Elliott, *S. trifoliatum* L., and *S. confertifolium* Small, all of which Cronquist recognized as species. It should also include *S. simpsonii* Greene, which Cronquist placed in synonymy of *S. gracile* A. Gray. These taxa all share the characteristics of having a variable number of ray flowers ranging from 8 to 21 and lanceolate to ovate leaves. Cronquist used phyllotaxy and presence or absence of pubescence on stems, leaves, and paleae to distinguish between these species. However, my field observations reveal variability in these characters within populations found where the geographical ranges of these taxa overlap. This variability is symptomatic of introgression between these taxa. Therefore, because of the introgression, they should be recognized at the varietal level rather than as separate species.

Silphium dentatum already has varietal status as *S. asteriscus* var. *dentatum* (Elliott) Chapman and will be recognized as such (Chapman, 1860). *Silphium trifoliatum* var. *trifoliatum*, *S. trifoliatum* var. *latifolium* A. Gray, and *S. simpsonii* should be transferred herein to *S. asteriscus*. *Silphium confertifolium* will be placed in synonymy with *Silphium asteriscus* var. *latifolium*.

Silphium asteriscus L., Sp. Pl. 2: 920. 1753. TYPE: "Asteriscus coronae solis flore et facie" in Dillenius, Hort. Eltham., 42, t. 37, f. 42. 1732 (lectotype, designated by Perry (1937: 292)).

Silphium asteriscus var. **simpsonii** (Greene) J. A. Clevinger, comb. nov. Basionym: *Silphium simpsonii* Greene, Pittonia 4: 45. 1899. TYPE: U.S.A. Florida: Palma Sola, in damp ground in pine barrens, 8 July 1890, *J. H. Simpson 81* (holotype, US).

Silphium asteriscus var. *simpsonii* is most closely allied to *S. asteriscus* var. *dentatum* and *S. asteriscus* var. *angustatum*. They share the characteristic of stipitate glands on the paleae. Stipitate glands are absent in other varieties of *Silphium asteriscus* but are also found in *Silphium laciniatum* L., *Silphium perplexum* J. Allison, and *Silphium glutinosum* J. Allison. Additionally, *Silphium asteriscus* var. *simpsonii*, variety *dentatum*, and variety *angustatum*, along with variety *asteriscus* and variety *scabrum*, share the characteristics of predominantly alternate phyllotaxy and scabrous to hispid leaves. This is in contrast to the predominantly opposite or whorled phyllotaxy and glabrous leaves of variety *trifoliatum*

and variety *latifolium*. *Silphium asteriscus* var. *simpsonii* can be distinguished from its closest allies, variety *dentatum* and variety *angustatum*, by its height (0.2–1.1 m vs. 0.5–1.5 m) and persistent basal rosette.

Silphium asteriscus var. *simpsonii* is restricted to the southeastern U.S. and is primarily found in Florida. Perry (1937) divided *Silphium simpsonii* into two varieties. *Silphium simpsonii* var. *wrightii* Perry, found in the southwestern U.S., should not be included here. Rather, because of its large number of ray flowers (20 to 30+), I reduce *Silphium simpsonii* var. *wrightii* to synonymy of *S. radula* var. *radula*. During the summer of 2002, *Silphium asteriscus* var. *simpsonii* was collected in Florida and added to the Clevinger and Panero (2000) molecular data set for phylogenetic analysis. In the resulting phylogenetic tree, *Silphium asteriscus* var. *simpsonii* was allied with *Silphium asteriscus* rather than *Silphium radula*.

Silphium asteriscus var. **trifoliatum** (L.) J. A. Clevinger, comb. nov. Basionym: *Silphium trifoliatum* L., Sp. Pl. 2: 920. 1753. *Silphium ternifolium* Michaux, Fl. Bor. Amer. (Michaux) 2: 146. 1803. TYPE: "Habitat in Virginia" (lectotype, designated by Reveal in Jarvis & Turland (1998: 367), LINN microfiche # 1032.8, photos, F, GH).

Fieldwork shows that *Silphium asteriscus* var. *trifoliatum* is most closely allied to *Silphium asteriscus* var. *latifolium*. They share the characteristics of glabrous leaves, peduncles, and stems in contrast to all other varieties of *Silphium asteriscus*. *Silphium asteriscus* var. *trifoliatum* is easily distinguished in the northeastern U.S. because of its trifoliate leaf arrangement. However, these same populations also contain individuals with alternate, opposite, or 4-foliate leaf arrangements. Along the southern edge of the varietal range, where it overlaps with *S. asteriscus* var. *asteriscus* and *S. asteriscus* var. *latifolium*, these alternate, opposite, and 4-foliate leaf arrangements become more predominant.

Silphium asteriscus var. **latifolium** (A. Gray) J. A. Clevinger, comb. nov. Basionym: *Silphium trifoliatum* L. var. *latifolium* A. Gray, Syn. Fl. N. Amer. 1: 241. 1884. TYPE: U.S.A. Alabama: July 1840, *S. B. Buckley s.n.* (holotype, GH).

Silphium confertifolium Small, Fl. S.E. U.S. 1243, 1340. 1903. Syn. nov. TYPE: U.S.A. Alabama: Choctoaw Co., Cocoa, 13–15 Oct. 1896, *C. Schuchert s.n.* (holotype, NY; isotypes, NY, US).

Like the other varieties of *Silphium asteriscus*, variety *latifolium* has ray flowers that number 8 to 21. This variety is distinguished by its predominantly opposite phyllotaxy and glabrous leaves and stems. In my fieldwork, I found that when *Silphium asteriscus* var. *latifolium* populations come in contact with variety *asteriscus* there is a mix of glabrous and pubescent plants. When its populations come in contact with variety *trifoliatum*, there is a mix of opposite and trifoliate leaf arrangements on the plants. Because of this introgression that I observed in the field, variety *latifolium* is placed in *S. asteriscus*.

I conclude that *Silphium confertifolium* represents an environmental variant of *S. trifoliatum* var. *latifolium* and should not retain its status as a distinct species. This is based upon examination of herbarium specimens and visits to sites in Dallas Co., Alabama, which is the locality of historic *S. confertifolium* collections (*Godfrey 69684*, *Jones 752*, NCU). Cronquist (1980) distinguished these two species on the basis of height and leaf distribution. *Silphium confertifolium* ranges in height from 0.4 to 1 m with basally disposed leaves, while *Silphium trifoliatum* var. *latifolium* ranges in height from 1 to 2 m with evenly distributed leaves. In the field I observed a continuum of plants within populations that varied in stature and leaf distribution according to proximity to chalk outcroppings. The plants closest to the chalk outcroppings were always the shortest in height with reduced leaves, and the ones furthest were tallest in height with evenly distributed leaves.

The recognition of *Silphium asteriscus* var. *trifoliatum* and variety *latifolium* is in agreement with the dissertation work of W. R. Weber (1968). Weber conducted extensive hybridization studies and concluded that *S. asteriscus* and *S. trifoliatum* are not reproductively isolated. Weber also concluded that phyllotaxy was variable between these two species. Weber and his adviser, T. R. Fisher, proposed in Weber's dissertation that *S. trifoliatum* var. *trifoliatum* and *S. trifoliatum* var. *latifolium* should be reduced to varietal rank within *S. asteriscus*. However, these changes were never formally published.

Silphium radula Nuttall

Silphium radula Nuttall, Trans. Amer. Philos. Soc., n.s. 7: 354. 1841. TYPE: U.S.A. Plains of Arkansas, *T. Nuttall s.n.* (holotype, BM).

Silphium simpsonii Greene var. *wrightii* L. M. Perry, Rhodora 39: 288. 1037. Syn. nov. TYPE: U.S.A. Texas: 1848, *C. Wright s.n.* (holotype, GH).

Silphium simpsonii var. *wrightii* is reduced here-

in to synonymy of *Silphium radula* based on the examination of the type specimen at GH. Gandhi and Thomas (1989) recognized both *S. radula* and *S. simpsonii* var. *wrightii* and stated that they differ only in the number of capitula and leaf texture. I have observed that these differences are quite variable, and these two entities should not be separated.

Silphium radula var. **gracile** (A. Gray) J. A. Clevinger, comb. et stat. nov. Basionym: *Silphium gracile* A. Gray, Proc. Amer. Acad. Arts 8: 653. 1873. TYPE: U.S.A. Texas: Harris Co., Houston, 1842, *F. J. Lindheimer s.n.* (lectotype, selected here, GH; isotype, GH).

Silphium radula var. *gracile* is recognized by a persistent basal rosette and ray flowers numbering 12 to 18. In contrast, *Silphium radula* var. *radula* has a caducous basal rosette and ray flowers numbering 20 to 30. Perry (1937) and others have suggested that the southwestern U.S. *Silphium radula* var. *gracile* is allied to the southeastern U.S. *Silphium asteriscus* var. *simpsonii*. These two varieties resemble one another in their persistent basal rosettes and reduced stature. However, *Silphium radula* var. *gracile* and variety *radula* have pubescent phyllaries and are found in Arkansas, Louisiana, Oklahoma, and Texas, while *Silphium asteriscus* var. *simpsonii* has glabrous phyllaries and is found in Alabama, Florida, Georgia, Mississippi, and South Carolina. *Silphium radula* var. *gracile* (as *Silphium gracile*) was included in the molecular study of Clevinger and Panero (2000). On the basis of ITS and ETS sequence data, this variety was demonstrated to be sister to *S. radula* var. *radula*.

Asa Gray cited two collections, those of Hall and of Lindheimer, in his description of *Silphium gracile*. He did not designate either as the holotype; therefore, they are syntypes. According to Gray, the Lindheimer specimens have larger leaves and more pubescence than the Hall specimens. Both descriptions fit Gray's concept of *S. gracile* and my concept of *S. radula* var. *gracile*. I have seen the two Lindheimer collections at GH. The status of the Hall collections is uncertain; I have seen two 1872 collections at F and NY labeled *Hall 321* (Gray does not cite a number in his description) but none at GH. Given this uncertainty, I have chosen the Lindheimer collection at GH to serve as the lectotype.

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Phylloscirpus (Cyperaceae) Revisited

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ABSTRACT. Two species of *Scirpus* are transferred to *Phylloscirpus*: *Scirpus deserticola* Philippi and *Scirpus boliviensis* Barros. *Phylloscirpus deserticola* has all the typical characteristics of the genus *Phylloscirpus*, such as eligulate leaves, a terminal head of spikelets, and scabrid hypogynous bristles. The allocation of *Scirpus boliviensis* to *Phylloscirpus* is morphologically less obvious due to its reduced structures, but is well supported by a phylogenetic analysis based on plastid *rbc*L and *trn*L-F sequence data. *Phylloscirpus deserticola* is lectotypified because the holotype consists of a mixed collection.

Key words: Andes, Cyperaceae, *Phylloscirpus*.

Phylloscirpus C. B. Clarke (1908) is a genus with a single species, *Phylloscirpus acaulis* (Philippi) Goetghebeur & D. A. Simpson (1990), distributed in Andean regions of South America. Clarke (1908) described the genus based on the presence of a dense head of spikelets subtended by bracts, each spikelet having spirally arranged glumes and bisexual flowers comprising five or six scabrid, hypogynous bristles.

During our ongoing taxonomic study of *Scirpus* s.l. in the Andes, it became clear that one of the species, *Scirpus deserticola* Philippi, clearly has the diagnostic features of *Phylloscirpus*, justifying a new combination within the genus. Another and very small species, *Scirpus boliviensis* Barros, also has characters in common with the species of *Phylloscirpus*, such as eligulate leaves and numerous red tannin idioblasts in the glumes. Although Clarke did not mention these characters in his original description, our observations and a molecular analysis discussed below strongly indicate that *Scirpus boliviensis* Barros should be included in the genus *Phylloscirpus*. However, as *Scirpus boliviensis* Barros has one terminal spikelet (opposed to a head of spikelets) and no bristle hairs, it is necessary to redefine *Phylloscirpus*, to give the genus a broader circumscription.

This proposal to make two new combinations in *Phylloscirpus* is well supported by our phylogenetic analysis based on *rbc*L and *trn*L-F sequencing data of several Andean *Scirpus* species.

MATERIAL AND METHODS

MORPHOLOGICAL DATA

Morphological data were obtained from the study of herbarium material with a stereomicroscope. Herbarium material from the following herbaria was studied: AAU, B, BM, C, GENT, GH, GOET, ISC, K, NY, P, QCA, SGO, SI, U, and US.

MOLECULAR DATA

The plant material used for DNA extraction and its provenance are listed in Table 1. Total DNA was isolated using the modified CTAB method of Doyle and Doyle (1987). Amplification was done in overlapping pieces using the 1F, 1024F, 724R, 1024R, and 1460R primers for the *rbc*L gene (Muasya et al., 1998) and the c, d, e, and f primers for *trn*L-F (Taberlet et al., 1991). The amplified products were cleaned using the QIAquick Kit according to the manufacturer's protocols (Qiagen, Ltd.), and sequenced using standard dideoxy methods and run on an ABI 377 automated sequencer (all according to the manufacturer's protocols, Applied Biosystems, Inc.). The sequences were edited in Sequence Navigator, assembled in Autoassembler (Applied Biosystems, Inc.), and aligned by eye in a sequence matrix of *Scirpus* s.l. (Muasya et al., 2000).

PHYLOGENETIC ANALYSIS

The molecular data set was analyzed using parsimony algorithms of PAUP* 4.0b8 (Swofford, 2002). A heuristic search of 1000 replicates with the TBR (tree-bisection-reconnection) swapping algorithm and random addition was conducted, retaining five trees at each step. Internal support was estimated with 1000 bootstrap replicates. For each bootstrap replicate, 100 heuristic searches with random sequence addition were conducted.

TAXONOMY

Phylloscirpus deserticola (Philippi) Dhooge & Goetghebeur, comb. nov. Basionym: *Scirpus deserticola* Philippi, Fl. Atacam.: 53. 1860. TYPE: Chile. Agua de profetas in deserto Atacamensi, Jan. 1854, *R. A. Philippi s.n.* (lectotype, selected here, SGO 046286 A). Figure 1A, D.

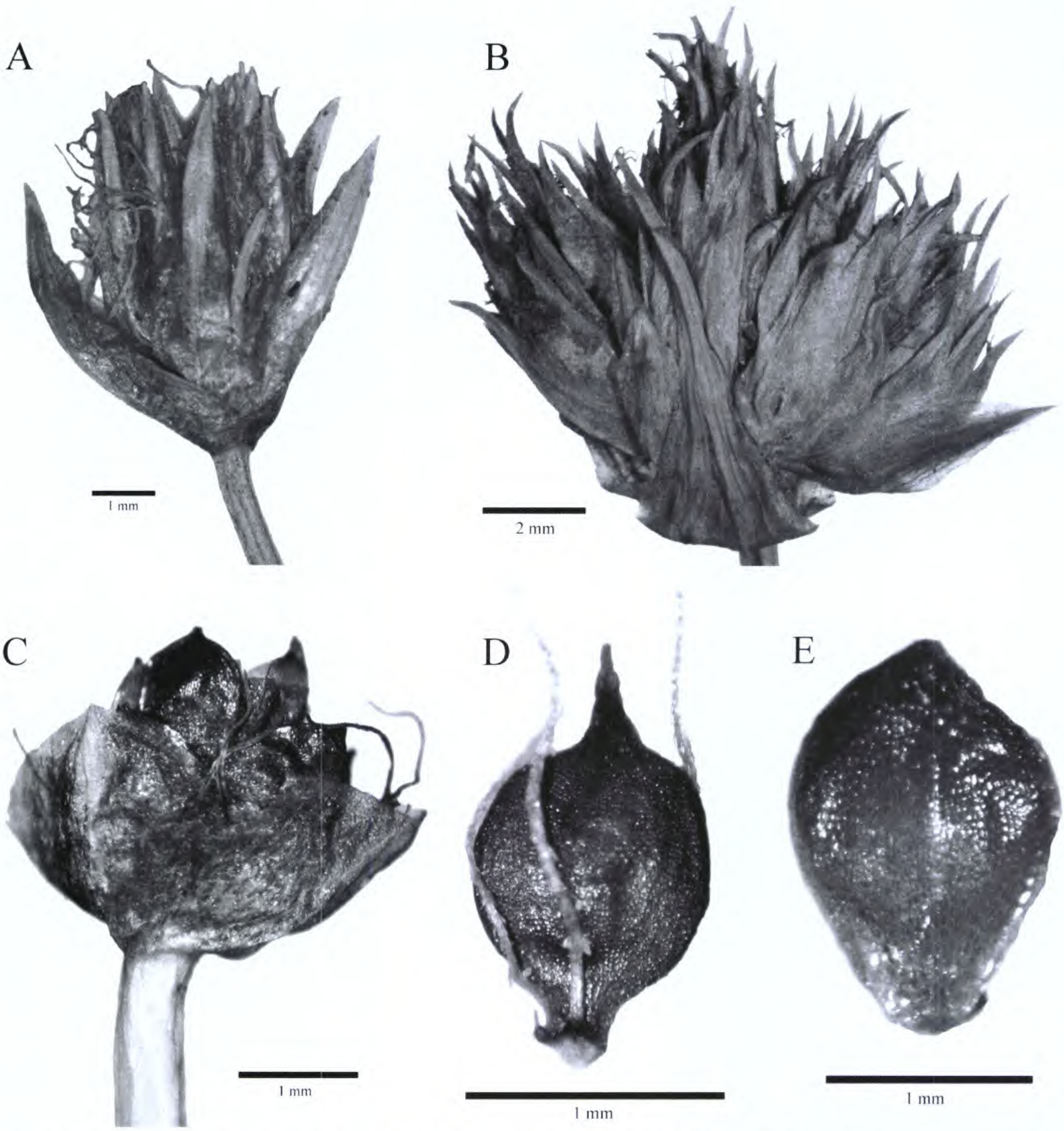

Figure 1. A and D. *Phylloscirpus deserticola* (Philippi) Dhooge & Goetghebeur (*Philippi s.n.*, lectotype, SGO). —A. Inflorescence. —D. Fruit with bristle hairs. —B. Inflorescence of *Phylloscirpus acaulis* (Philippi) Goetghebeur & D. A. Simpson (*Ruthsatz 8765*, GENT). C and E. *Phylloscirpus boliviensis* (Barros) Dhooge & Goetghebeur (*Petersen & Hjerting 1043b*, holotype, C). —C. Inflorescence. —E. Fruit.

Scirpus semisubterraneus Boeckeler, Linnaea 36: 495. 1870. *Scirpus deserticola* Philippi var. *semisubterraneus* (Boeckeler) Barros, Anal. Mus. Argent. Cienc. Nat. 38: 156. 1935. TYPE: Peru. W. Lechler n° 1977 (holotype, not seen; isotypes, K, P).

Caespitose, small herbs, 1.8–12 cm tall; rhizomes creeping, branching; culms 0.6–10 cm × 0.5–1.3 mm, terete, glabrous, sometimes with little red spots (tannin idioblasts), covered with old brown leaf sheaths. Leaves shorter than to as long as the culm; leaf sheaths 2.5–6.5 mm long, often with red spots; leaf blade 0.3–1.9 cm × 0.4–0.85 mm, scabrous toward the leaf tip; leaf tip muticous, often orange; ligule absent. Inflorescence a single spikelet or a terminal, dense head composed of 2 to 6 spikelets (Fig. 1A), 4–7.2 × 1.5–8 mm, red-brown to dark brown; when 2 or more spikelets are present, each lateral spikelet subtended by a bract and a small, membranous prophyll; bracts 3.4–6.5 × 2–4 mm, red-brown with many tannin idioblasts and a conspicuous, swollen, pale midrib, apiculate, as long as to slightly shorter than the inflorescence. All glumes fertile, 2.7–4.7 × 1.5–1.9 mm, ovate, red-brown with many red spots (tannin idioblasts) and a conspicuous, swollen, pale midrib; flowers bisexual; stamens 3; ovary 3-carpellate; style

Table 1. Taxa from Cyperaceae analyzed in the combined *rbc*L-*trn*L-F study. Literature citations are given for previously published sequences.

Taxon	Source/Voucher	Provenance	*rbc*L	*trn*L-F intron, exon & spacer	*trn*L-*trn*F intron	*trn*L-F exon & spacer
Actinoscirpus grossus (L.f.) Goetghebeur & D. A. Simpson	Muasya et al. (1998)	Malaysia	Y12953		AJ295765	AJ577319
Ascolepis capensis (Kunth) Ridley	Muasya et al. (1998)	Kenya	Y13003		AJ295757	AY040594
Blysmus compressus Panzer	Muasya et al. (2000a)	Afghanistan	AJ404700		AJ295766	AJ577320
Cyperus papyrus L.	Muasya et al. (1998)	Chad	Y12966		AJ295759	AJ577321
Eriophorum angustifolium Honckeny	Muasya et al. (2000a)	Ireland	—	AJ577335		
Eriophorum vaginatum L.	Muasya et al. (1998)	Poland	Y12951		AJ295769	AJ577322
Fimbristylis dichotoma (L.) Vahl	Muasya et al. (1998)	Kenya	Y13008		AJ295755	AJ577323
Helmuthia membranacea (Thunberg) R. W. Haines & Lye	Muasya et al. (1998)	South Africa	Y13000		AJ295815	AJ577324
Hypolytrum nemorum (Vahl) Sprengel	Muasya et al. (1998)	Malaysia	Y12958		AJ295816	AJ577325
Isolepis hystrix (Thunberg) Nees	Muasya et al. (2000a)	South Africa	AJ404711		AJ295785	AJ577326
Isolepis setacea (L.) R. Brown	Muasya et al. (1998)	Kenya	Y12962		AJ295799	AJ577327
Kyllingiella microcephala (Steudel) R. W. Haines & Lye	Muasya et al. (2000a)	Zimbabwe	AY040592		AJ295807	AJ577328
Kyllingiella polyphylla (A. Richard) Lye	Muasya et al. (1998)	Tanzania	Y13013	AJ297515		
Mapania cuspidata (Miquel) Uittien	Muasya et al. (1998)	Brunei	Y12955		AJ295817	AJ577329
Oreobolopsis tepalifera T. Koyama & Guaglianone	*Lægaard et al. 21493* (AAU, GENT, QCA)	Ecuador	AJ575932	AJ576035		
Phylloscirpus acaulis (Philippi) Goetghebeur & D. A. Simpson	*Ruthsatz 9341* (GENT, TRIER)	Argentina	AJ575926	AJ576029		
Phylloscirpus boliviensis (Barros) Dhooge & Goetghebeur	*Lægaard 102805* (AUU, GENT)	Ecuador	AJ566081	AJ566082		
Phylloscirpus deserticola (Philippi) Dhooge & Goetghebeur 01	*Lægaard 21478* (AAU, GENT, QCA)	Ecuador	5′ AJ704783 3′ AJ704784	AJ704786		
Phylloscirpus deserticola (Philippi) Dhooge & Goetghebeur 02	*Beck 21816* (GENT)	Bolivia	AJ704785	AJ704787		
Phylloscirpus deserticola (Philippi) Dhooge & Goetghebeur 03	*Ruthsatz 8304* (GENT, TRIER)	Chile	5′ AJ575925 3′ AJ575935	AJ576028		
Pycreus flavescens (L.) Reichenbach	Muasya et al. (1998)	Kenya	Y13005		AJ295763	AJ577330

Table 1. Continued.

Taxon	Source/Voucher	Provenance	*rbc*L	*trn*L-F intron, exon & spacer	*trn*L-*trn*F intron	*trn*L-F exon & spacer
Schoenoplectus lacustris (L.) Palla	Muasya et al. (1998)	Britain	Y12943		AJ295809	AJ577331
Schoenoplectus pungens (Vahl) Palla	*Mac Gregor 15733* (K)	USA, Kansas	—		AJ577336	—
Schoenus nigricans L.	Muasya et al. (1998)	Arabia	Y12983		AJ295814	AJ577332
Scirpoides holoschoenus (L.) Soják	Muasya et al. (1998)	South Africa	Y12994		AJ295811	—
Scirpus polystachyus F. Mueller	Muasya et al. (1998)	Australia	Y12974		AJ25813	AJ577333
Trichophorum cespitosum (L.) Hartman	Muasya et al. (1998)	British Isles	Y12969			
Trichophorum rigidum (Steudel) Goetghebeur, Muasya & D. A. Simpson	Muasya et al. (2000a)	Argentina	AJ297509		AJ295808	AJ577334
Zameioscirpus atacamensis (Philippi) Dhooge & Goetghebeur	*Ruthsatz 9884* (TRIER, US)	Argentina	AJ575929	AJ576032		
Zameioscirpus gaimardioides (E. Desvaux) Dhooge & Goetghebeur	*Ruthsatz 9676* (TRIER, US)	Argentina	5′ AJ575928 3′ AJ575938	AJ576031		
Zameioscirpus muticus Dhooge & Goetghebeur	*Ruthsatz 9212* (GENT, TRIER)	Argentina	AJ575927	AJ576030		

branches 3; perianth segments 3 to 6, bristle-like, shorter to somewhat longer than the fruit, retrorsely scabrous. Fruit 1.1–1.7 × 0.6–0.9 mm, ovate, rounded trigonous in cross section, brown with a reticulate surface and black remnant of the style base; basal part of the fruit constricted (Fig. 1D).

Habitat and distribution. In páramo or puna vegetations at elevations of 3200–4830 m from Argentina, Bolivia, Chile, Ecuador, and Peru.

Phenology. Flowering year round (pers. obs.).

The holotype sheet of *Scirpus deserticola* Philippi (*SGO 046286*) is a mixture of *Phylloscirpus deserticola* with *Phylloscirpus acaulis.* According to the ICBN (Greuter et al., 2000: Art. 9.9) part of Philippi's specimen has to be designated as the lectotype. As it is difficult to decide which part of the type corresponds with Philippi's superficial description of *Scirpus deserticola,* we have selected the lectotype so as to preserve the current usage of the two names (Greuter et al., 2000: Rec. 9A.5). The type of *Phylloscirpus deserticola* is part A on the herbarium specimen SGO 046286, located at the lower left side of the sheet.

Representative specimens examined. ARGENTINA. **Jujuy:** Humahuaca, Mina Aquilar, Mina Esperanca, vega 106, 4 Mar. 1997, *B. Ruthsatz & B. Erschbamer 9797* (US). BOLIVIA. **La Paz:** Murillo, 1 km al N (abajo) de la represa del Lago Zongo, 21 Jan. 1987, *J. C. Solomon 15819* (GENT). CHILE. **Antofagasta:** El Loa, Río Putana, 19 Mar. 1992, *B. Ruthsatz 8347* (GENT). ECUADOR. **Tungurahua:** 2.4 km along Angamarca road from Latacunga–Mana road, 26 July 2001, *S. Laegaard et al. 21478* (GENT). PERU. **Ancash:** Carhuaz, Huascarán National Park, lateral valley of Quebrada Ishinca, 12 Feb. 1985, *D. N. Smith et al. 9471* (GENT, ISC).

Phylloscirpus boliviensis (Barros) Dhooge & Goetghebeur, comb. nov. Basionym: *Scirpus boliviensis* Barros, Darwiniana 11: 764. 1959. TYPE: Bolivia. Potosí: Quijarro, alt. 4350 m, 27 Feb. 1953, *E. Petersen & J. P. Hjerting 1043b* (holotype, C; isotype, US). Figure 1C, E.

Note: The label of the isotype mentions only Hjerting as collector and 1043 as the collector number. Other label data are identical to the label on the holotype specimen.

Small herb, 2–4 cm tall; rhizomes erect, branching; culms 1–4 cm × 0.4–0.6 mm, bluntly trigonous or terete below the inflorescence, glabrous. Leaves green, shorter than the culms; leaf sheath 2.5–4 mm long, brown; leaf blade 4–7 × 0.3–0.4 mm, glabrous; leaf tip muticous, orange or brown; ligule absent. Inflorescence always a single, terminal spikelet, globose, 2–3 mm diam. (Fig. 1C); bracts absent. Proximal glume 2 mm long, bract-like, with a small, pale awn, red-spotted (tannin idioblasts), subtending a flower; other glumes 0.8–1 mm long, obtuse, with tannin idioblasts; flowers bisexual; stamens 2; style branches 2 or 3; perianth not developed. Fruit 1.2–1.6 × 0.7–1.2 mm, ovate, plano-convex, brown, reticulate, shiny (Fig. 1E).

Habitat and distribution. Often growing in dense cushions of *Distichia muscoides* Nees & Meyen (Juncaceae) in páramo or puna vegetations, 4190–4800 m elevation, from Bolivia, Chile, Colombia, Ecuador, and Peru.

Phenology. Noted flowering in February through May and October.

The assignment of *Scirpus boliviensis* to *Phylloscirpus* is at first not very obvious. *Phylloscirpus acaulis* and *Phylloscirpus deserticola* have a number of features in common such as a head of spikelets (Fig. 1A, B), the ovate shape of the fruit with a basal constriction, and the presence of the scabrid, bristle-like perianth segments. However, these characters cannot be found in *Scirpus boliviensis.* On the contrary, this species is morphologically very reduced, and so the number of available characters is limited. Within the tribe Scirpeae, *Scirpus boliviensis* differs from related genera such as *Amphiscirpus, Oreobolopsis, Trichophorum,* and the new genus *Zameioscirpus* (Dhooge et al., 2003) by the absence of a ligule, which is a useful diagnostic character within the tribe (Camelbeke & Goetghebeur, 1999). *Scirpus boliviensis* also morphologically resembles *Eleocharis,* but the latter has very reduced leaf blades.

Our initial idea was to create a new, monotypic genus for *Scirpus boliviensis.* However, a number of arguments can be given to put the species in *Phylloscirpus.* The three species all have eligulate leaves, their glumes have numerous tannin idioblasts visible as red spots, and the inflorescence of *Phylloscirpus deserticola* can also be reduced to one single spikelet (*B. Ruthsatz & B. Erschbamer 9797,* US). Significant additional support is given by the phylogenetic analysis discussed below.

Representative specimens examined. BOLIVIA. **Oruro:** Sajama, unos 4 km del pueblo, subiendo el valle del río Sururia, 10 Apr. 1995, *S. Beck 22360* (GENT, LPB). CHILE. Sümpfe der Puna um den Lago Chungará, 5 Mar. 1927, *C. Troll 3175* (B). COLOMBIA. **Arauca:** Sierra Nevada del Cocuy, Cabeceras de la Quebrada El Playón, Patio Bolos, 1.5–2 km al E-NE del Alto Cusirí, 8 Mar. 1973, *A. M. Cleef 8941A* (U). ECUADOR. **Pichincha:** páramo of Volcán Cayambe, ascent to refugio on N side, 23 Oct. 1995, *B. Øllgaard 1208* (AAU, QCA). PERU. **Ancash:** Recuay, Huascarán National Park, Quebrada Queshque, lateral valley toward Rio Pachacoto, 18 Mar. 1986, *D. N. Smith et al. 11828* (GENT).

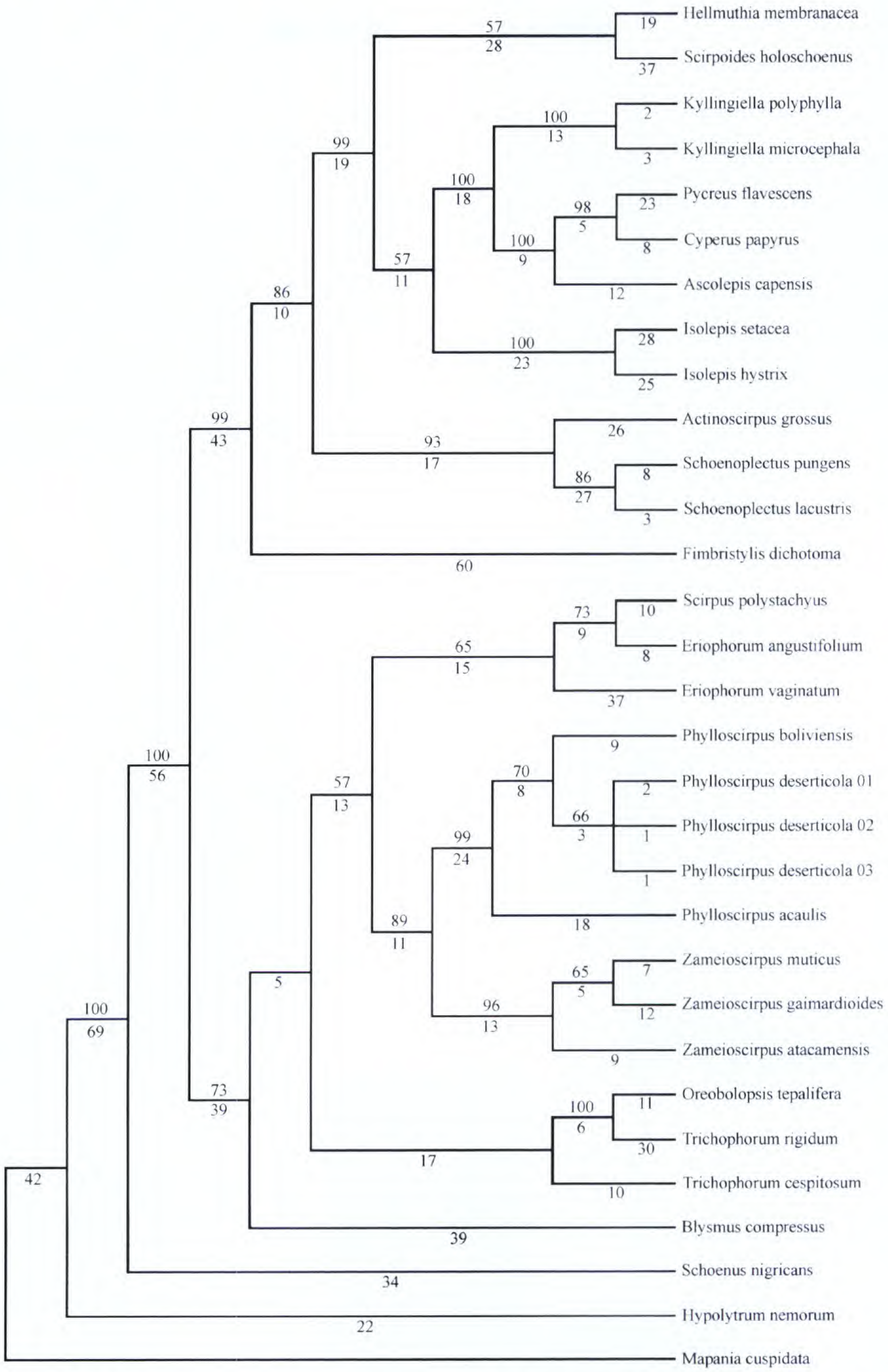

Figure 2. One of the two most parsimonious trees derived from *rbc*L and *trn*L-F data. Branch lengths are shown below the branches, and bootstrap percentages are shown above.

Phylogenetic Analysis

The data matrix has 354 parsimony-informative characters. Analysis of equally weighted characters produced two trees of length = 1072 steps, with consistency index (CI) = 0.79 and retention index (RI) = 0.85. The two trees do not differ in regard to *Phylloscirpus*, but in the position of *Trichophorum cespitosum* (bootstrap value < 50%, not indicated on tree). One of the two most parsimonious trees is shown in Figure 2.

The molecular analysis (unpublished) confirms the isolated position of *Phylloscirpus* (bootstrap value 99%), which is well separated from other evolutionary lines, and gives us additional support to make the two new combinations. Molecular evidence places *Phylloscirpus* in the tribe Scirpeae, corresponding to the interpretations of Goetghebeur (1986) and Bruhl (1995) for the tribe, including a possible sister group *Zameioscirpus* Dhooge & Goetghebeur.

An Emended Description of *Phylloscirpus* C. B. Clarke

Phylloscirpus C. B. Clarke, Bull. Misc. Inform., Addit. Ser. 8: 45. 1908. TYPE: *Phylloscirpus andesinus* C. B. Clarke [= *Phylloscirpus acaulis* (Philippi) Goetghebeur & D. A. Simpson].

Small, perennial and rhizomatous herbs. Leaves basal, tristichous, eligulate. Inflorescence terminal, 1 spikelet or a dense, small head of spikelets subtended by inflorescence bracts. Each spikelet has spirally arranged glumes and ca. 4 to 6 bisexual flowers. Stamens 2 or 3. Perianth segments 2 to 6, bristle-like, retrorsely scabrid, deciduous with the fruit, or perianth segments not developed; ovary di- or trimerous.

Key to the Species of *Phylloscirpus* in South America

1a. Perianth segments absent . . . *Phylloscirpus boliviensis*
1b. Perianth segments present, bristle-like 2
  2a. Inflorescence 0.9–1.5 cm long; glumes thin, membranaceous, concolorous, yellowish brown . . . . . *Phylloscirpus acaulis*
  2b. Inflorescence 4–7.2 mm long; glumes brown, with thickened, yellow midnerve. . . . . *Phylloscirpus deserticola*

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Passiflora phellos, a New Species in Subgenus *Passiflora* (Passifloraceae)

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ABSTRACT. *Passiflora phellos* sp. nov. is described in subgenus *Passiflora* series *Laurifoliae*, more precisely, among the few species that have the first row of corona filaments shorter than the second row. This new species is known from the western Amazonian basin (Brazil, Peru, and Venezuela) and is unique in this group for its thick and fissured bark.

Key words: Brazil, *Passiflora*, Passifloraceae, Peru, ser. *Laurifoliae*, Venezuela.

Passiflora L. is the largest genus in the Passifloraceae, with more than 500 species. About 20 of these species occur from South Asia to Australia, and the vast majority are American from the mid-Atlantic region of the U.S.A. (*P. incarnata* L. and *P. lutea* L.) to northern Chile and Argentina (*P. caerulea* L.). The genus is defined by the floral structure, with the ovary and the stamens borne on an androgynophore and the complexity of the extrastaminal corona. Nevertheless, species show large differences in floral morphology and a tremendous diversity in leaf shape and structure. The diversity within the genus *Passiflora* is reflected in the large number of names published for infrageneric taxa and segregate genera (190; Feuillet & MacDougal, in prep.).

Species in *Passiflora* subg. *Passiflora* are herbaceous or semi-woody climbers. The leaf venation is pinnate or palmate, rarely pedate. Inflorescences, or more accurately florescences, are sessile, 1- to 2-flowered cymes whose terminal flower is a tendril, sometimes grouped in a racemose synflorescence and then without tendril. The displaced bract and the 2 bracteoles (referred to as bracts below) form a usually large and showy verticil, under the flower. An operculum tubular or filamentose and a limen membranous at least at base are borne in the cylindrical to campanulate floral tube. If known, the chromosome number is $n = 9$ (Snow & MacDougal, 1993).

The new *Passiflora phellos* belongs to *Passiflora* subg. *Passiflora* ser. *Laurifoliae* Killip ex Cervi. This series includes 21 species that have unwinged stems, setaceous to narrowly triangular stipules, unlobed leaves, margin entire or (in *P. nitida* Kunth) sometimes minutely serrulate, one pair of petiolar nectaries, bracts free to the base, more than 1 cm long, entire to dentate, foliaceous and usually persistent, flowers large, usually hanging, and corona well-developed, often campanulate around the stamens and the ovary.

Passiflora phellos C. Feuillet, sp. nov. TYPE: Venezuela. Amazonas: río Yatua, just above Piedra Arauicaua, 130 m, 16 July 1959, *J. J. Wurdack & L. S. Adderley 43479* (holotype, NY). Figure 1.

Species haec ad *Passifloram* ser. *Laurifoliae* pertinens; ab aliis speciebus caule suberoso, profunde fissurato differt; stipulis linearibus, glandibus petiolaribus ad apicem, foliis integerrimis, oblongis-ellipticis, bracteis involucratis libris integris foliaceis glandulosis, sepalis et petalis extus blancis vel viridibus, intus purpureis, filamentis extimis coronae 3/5 brevioribus quam secundis, et fructibus aurantiacis distincta.

Woody climber with tendrils. Stems covered with deeply fissured cork forming fragmented ridges, not only at base but up to most of the leafy and blooming, herbaceous parts, ridges up to 1 cm tall in old stems, distal internodes with an indumentum of minute, stiff, white hair; vegetative bud with more than 5 prophylls. Leaves simple; stipules linear, 3–5 mm long, early deciduous; petiole 0.5–1.5 cm long, canaliculate, bearing one pair of sessile glands near the apex, glands 2 × 2 mm, circular, with a rim 0.5 mm thick, often accompanied proximally by islets of cork; lamina narrowly oblong to oblong-elliptic, 8–17.5 × 2.8–4.5(–7) cm, margin entire, rounded to cuneate at base, apex shortly acuminate, acumen slightly curved, or acuminate and aristate, (6–)8–12(–18) pairs of secondary veins, these prominent on both faces, adaxially glabrous, abaxially with minute, stiff, white trichomes. Flowers hanging, one per leaf axil; peduncle 1–5.5 cm long, bearing three bracts 2–3 mm from the base of the flower; bracts verticillate, sessile, ovate, 2–4 × 1–2 cm, with marginal, sessile glands, apex acute; floral tube campanulate; sepals elliptic, ca. 4 × 2 cm, green or white outside, purple inside,

Figure 1. *Passiflora phellos* Feuillet. —A. Leafy stem. —B. Older stem with thick suber. —C. Apex of petiole with glands and suber islets. —D. Flower. —E. Flower, longitudinal section. —F. Pedicel, bracts, and floral tube. —G. Detail of bract margin with gland. —H. Fruit. —I. Seed. (After *Wurdack & Adderley 43479.*)

bearing a hooked, subterminal awn, 2–3 mm long, with minute, stiff, white trichomes; petals elliptic, acute at apex, green or white outside, purple inside, ca. 3–3.5 × 0.5–1 cm; corona in several rows, the 2 outer rows of thick filaments, outermost row of filaments 2–2.5 cm long, the second outer row of filaments longer than the outermost row, 3–3.5 cm long, inner several rows of small tubercles with a 0.5–0.7 mm long, filamentose apex, and last row of recurved short filaments, 1–1.2 mm long; androgynophore 2 cm long, glabrous; stamens glabrous, filaments flat, not spreading on the specimens studied, anthers dorsifixed, extrorse, parallel to the filaments and to the androgynophore; ovary elliptic, 8 × 4 mm, densely covered with erect, short, yellow trichomes, indumentum that gradually diminishes to the base of 3 clavate apical styles, 6–7 mm long, stigmas ca. 2 mm diam. Fruit ovoid, 3–6 × 2–4.5 cm, orange with pale spots at maturity; seeds ovate, asymmetric at apex, nearly flat, coarsely reticulate, ca. 6 × 4 mm, 1 mm thick in the middle, canaliculate at margin, each half crenate at margin, dark brown.

Distribution and ecology. *Passiflora phellos* is known at elevations from 90 to 150 m in Venezuela (Amazonas), Brazil (Amazonas), and Peru (Loreto). The vines grow in riparian forests and on top of shrubby vegetation on river beaches. Flowering is documented from May–July and fruiting from April–June.

Systematics. The thick and fissured corky bark resembling the suber of many tropical species of *Aristolochia* L. is uncommon in *Passiflora.* This character is found in a few species of *Passiflora* subg. *Decaloba* (DC.) Reichenbach sect. *Cieca* (Medikus) DC., for example, *P. suberosa* L., *P. sexocellata* Schlechtendal, and a few related species. In those taxa the suber is limited to old parts of a stem, a few feet away from leaves or flowers.

The new species can be inserted into Killip's key (1938: 60–61) between *Passiflora capparidifolia* Killip (sp. 209) and *P. laurifolia* L. (sp. 213), among species with the outermost row of corona filaments shorter than the second row. This group includes some species more recently described, e.g., *P. cerasina* Annonay & Feuillet, *P. fernandezii* Escobar, *P. pachyantha* Killip, and *P. rufostipulata* Feuillet.

Passiflora phellos is characterized by the thick development of cork on stems and petioles. Within this group it differs by its narrow leaves from all taxa except *P. capparidifolia* (sp. 209) and *P. popenovii* Killip (sp. 210), from *P. popenovii* by its apical petiolar glands (vs. basal or lacking), shorter peduncles, larger bracts, and purple perianth (vs. pink), and from *P. capparidifolia* by the outermost row of corona filaments reaching 3/5 of the length of the filaments of the second row (vs. ½ or less).

The specimen from Peru, *MacDaniel & Rimachi 32116,* shows variation from the rest of the collections available. The cork has many more smaller ridges and is restricted to the woody stems. Furthermore, stems, leaves, and tendrils are early glabrescent.

Etymology. The epithet "*phellos*" refers to the well-developed suber (= bark, cork) on old to young stems and even as islets on petioles.

Paratypes. VENEZUELA. **Amazonas:** Río Orinoco, a black water caño just above Tama Tama, on the right bank, 23 June 1959, *Wurdack & Adderley 43154* (NY, US). BRAZIL. **Amazonas:** Rio Cuieiras, near mouth of Rio Brancinho, black water igapó, 28 Apr. 1975, *Prance, Ramos & Schubert 23396* (INPA); upper Rio Negro basin, Uanadona, near mouth of Rio Dimití, 10 May 1948, *Schultes & López 9900* (US); Rio Negro, ig. próximo à S. Gabriel da Cachoeira, 15 May 1973, *Silva, Machado & Pires 1633* (INPA); Estrada Torquato–Tapajós, km 182, a 2.500 m da margem da estrada, igarapé do Péreu, 3 Apr. 1975, *Loureiro, Coelho, Mello, Monteiro, Lima & Moreira s.n.* (INPA-48401); Rio Xié, afluente do Rio Negro, 8 May 1973, *Silva, Machado & Pires 1344* (INPA). PERU. **Loreto:** Maynas, Punchana, Río Momón, mouth to Porvenir, Tahuampa, 10 Jan. 1994, *McDaniel & Rimachi 32116* (IBE, US).

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New Species of *Ixia* (Crocoideae) and *Moraea* (Iridoideae), and Taxonomic Notes on Some Other African Iridaceae

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Abstract. In Iridaceae subfamily Crocoideae, the tropical African *Gladiolus erectiflorus* subsp. *verdickii* and South African *Tritonia marlothii* subsp. *delpierrei* are restored to species rank as *G. verdickii* and *T. delpierrei*, respectively, while in the South African *Ixia*, *I. frederickii* is reduced to synonymy in *I. dubia* and a new species, *I. superba*, is described. That species, a member of *Ixia* sect. *Ixia* (20 species) is restricted to the Montagu district of the western Little Karoo, Western Cape Province, and has large pink flowers with a large dark blackish central zone. Most closely allied to a second Little Karoo species, *I. gloriosa*, *I. superba* is distinguished by the relatively long filaments 5–6 mm long, straight anthers ca. 6 mm long, and a style. The perianth tube is ca. 6 mm long, narrow at the base, forming a wide cup in the upper 3 mm. In subfamily Iridoideae, *Ferraria uncinata* subsp. *macrochlamys* is accorded separate status as *F. macrochlamys*, distinguished from *F. uncinata* by flower color, tepal proportions, and leaf marginal morphology, while a lectotype is designated for *F. kamiesbergensis*, the species evidently most closely allied to *F. macrochlamys*. In *Moraea* a new species, *M. simplex* (*Moraea* subg. *Visciramosa*, 7 species), is a local endemic of the Piketberg north of Cape Town, Western Cape, South Africa. It is distinguished from its allies by the subequal, spreading tepals with short claws, and short style that divides into three filiform, terminally stigmatic branches that extend between the filaments. We also provide new combinations at subspecies rank that were inadvertently not made when *Hexaglottis* and *Homeria* were transferred to *Moraea*, namely *M. bulbifera* subsp. *anomala*, *M. lewisiae* subsp. *secunda*, and *M. virgata* subsp. *karooica*. Lastly, in subfamily *Nivenioideae* we reinstate *Aristea torulosa* as the earliest name for plants currently called *A. woodii*, a species that extends from Tanzania and Angola to eastern South Africa.

Key words: Africa, *Aristea*, *Ferraria*, *Gladiolus*, Iridaceae, *Ixia*, *Moraea*, *Tritonia*.

This paper deals with a variety of nomenclatural and taxonomic issues in the African Iridaceae that have accumulated over the past several years. We take the opportunity to describe two new species, one of the crocoid genus *Ixia*, and the other of the iridoid genus *Moraea*, the latter as far as we can determine, first collected in the spring of 2002. In *Moraea* several infraspecific taxa were not transferred to the genus when *Homeria* and *Hexaglottis* were previously reduced to synonymy in *Moraea* (Goldblatt, 1998). Taxonomic adjustments include changes in rank for *Gladiolus erectiflorus* var. *verdickii*, *Tritonia marlothii* subsp. *delpierrei*, and *Ferraria uncinata* subsp. *macrochlamys*. We formally include *Ixia frederickii* in *I. dubia*, and re-establish use of the name *Aristea torulosa*, which we regard as an earlier name for plants currently called *A. woodii*. We also designate a lectotype for the narrow Namaqualand endemic *Ferraria kamiesmontana* and emend its circumscription.

The new *Ixia superba* is a member of the largely beetle-pollinated section *Ixia*, and evidently most closely related to the Little Karoo endemic *I. gloriosa*. *Moraea simplex* is the seventh member of subgenus *Visciramosa* of *Moraea*, a large African and Eurasian genus of 197 species at the latest count (Goldblatt & Manning, 2002). It stands out in the subgenus and genus in having simple, filiform style branches that spread between the tops of the free filaments. In most other species of *Moraea* the filaments and anthers are appressed to enlarged, erect style branches that are flattened and petal-like, and have forked apices (Goldblatt, 1986).

We present our new species and taxonomic corrections below with genera arranged alphabetically

within their subfamilies, using the infrafamilial taxonomy of Goldblatt (1990).

CROCOIDEAE

Gladiolus verdickii De Wildeman & T. Durand, Bull. Soc. Nat. Bot. Belgique 40: 29. 1901. *Gladiolus erectiflorus* var. *verdickii* (De Wildeman & T. Durand) Geerinck, Taxonomania 4: 3. 2001. TYPE: Congo. Shaba, Lukafu, July 1900, *E. Verdick 612* (type, BR).

We do not agree with Geerinck (2001) in his reduction of *Gladiolus verdickii* of Shaba in Congo and adjacent northwestern Zambia to varietal rank in *G. erectiflorus* Baker, the latter a largely East African species that also occurs in Shaba. While the two species seem clearly to be immediately related, *G. verdickii* differs consistently in numerous features, and is unlikely to be mistaken for *G. erectiflorus* (Goldblatt, 1996). As noted by Geerinck, *G. verdickii* shows no overlap in the dimensions of critical characters, notably the length of the perianth tube (25–35 mm vs. 16–18 mm in *G. erectiflorus*), dorsal tepal (45–50 vs. 25–35 mm), filaments (ca. 30 mm vs. 12–14 mm), and ovary (5.5–6.5 mm vs. ca. 3.5 mm). Moreover, their geographic ranges overlap to some extent in southeastern Shaba Province of Congo, yet there is no indication, based on examination of all collections of the species available at the time, that their characters converge there (Goldblatt, 1996). In fact, the populations of the two species maintain their differences throughout their ranges. Geerinck's reduction of *G. verdickii* seems to us simply founded on their apparent immediate relationship based on morphological comparison. In the case of *G. verdickii*, we would expect it to differ only in one or two features to merit varietal status in a second species. For *G. verdickii* we re-emphasize one particular difference between it and *G. erectiflorus*: plants produce numerous small cormlets, ca. 1.5 mm in diameter, on short, flattened fasciated stolons (Goldblatt, 1996: plate 30), a feature unknown elsewhere in *Gladiolus*, whereas *G. erectiflorus* produces slender runners bearing one or a few larger terminal cormlets up to 4 mm in diameter.

Ixia dubia Ventenat, Choix. pl. 2: sub. pl. 10. 1803. TYPE: South Africa. Without precise locality, collector, or date (type, G, Herb. Ventenat).

Ixia frederickii M. P. de Vos, S. African J. Bot. 54: 596. 1988. Syn. nov. TYPE: South Africa. Western Cape: Darling District, Bokbaai, 16 Oct. 1987, "*F. Duckitt sub de Vos 2694*" fide de Vos, 1988: 596 (holotype, STE; no isotypes cited).

In our account of the Iridaceae in the Cape flora (Goldblatt & Manning, 2000), we did not recognize *Ixia frederickii* M. P. de Vos, and included it provisionally in *I. dubia*. After further consideration, we maintain our opinion that *I. frederickii* is a distinctive local color variant of *I. dubia* and formally reduce it to synonymy. It was distinguished by de Vos (1988) by its fiery red flower color [sometimes orange-red] with a small dark center, black filaments 3.5–4.5 mm long, connivent around the central style that divides opposite the middle of the filaments, and the firm, often suborbicular bracts, 6–8 mm long, that are pale or flushed light purple above, with reddish purple veins. De Vos regarded the species as most closely related to *I. maculata* L. and *I. dubia*. *Ixia maculata* has larger, tawny rust-colored bracts 8–15 mm long, an orange, rather than red, flower with a large light brown central mark, and longer filaments and style. The filaments, 3–5 mm long, are usually connate basally or up to the middle, and the style divides above the level of the filaments, usually opposite the middle of the anthers. The yellow- to orange-flowered *Ixia dubia*, however, has shorter, translucent bracts 5–9 mm long, often pink or sometimes purple above and with several darker veins, the filaments free, 3–5 mm long, and a style that reaches the middle or top of the filaments. Its perianth ranges from pale to deep yellow or light orange, often flushed red on the outside, and it sometimes has a small darker central mark while the filaments are yellow or partly dark brownish. It is typically a plant of sandy soils, either stony sandstone or granitic slopes, where it grows in fynbos or coastal bush.

Given the range of variation in the flowers of *Ixia dubia*, we see no reason to recognize *I. frederickii*. It falls within the range of variation of *I. dubia*, with the fiery red perianth its only unique feature.

Ixia superba J. C. Manning & Goldblatt, sp. nov. TYPE: South Africa. Cape Province: Montagu District, Klipheuwel, foot of the Langeberg, in loamy sandstone soils or light clay, 9 Sep. 1993, *P. Goldblatt, J. C. Manning & L. J. Porter 12180* (holotype, NBG; isotypes, K, MO, PRE, S). Figure 1.

Plantae 20–60 cm altae, cormo globoso 15–20 mm diam., foliis tribus basalibus inferioribus duobus anguste ad late lanceolatis (3–)5–10 mm latis marginibus moderate incrassatis folio superiore caulem vaginanti, caule simplice vel 1–3 ramoso, spica usitate 3–6 florum spicis lateralibus 1–4 florum, bracteis membranaceis translucentibus exteriore 8–10 mm longo interiore pauciter longo vel

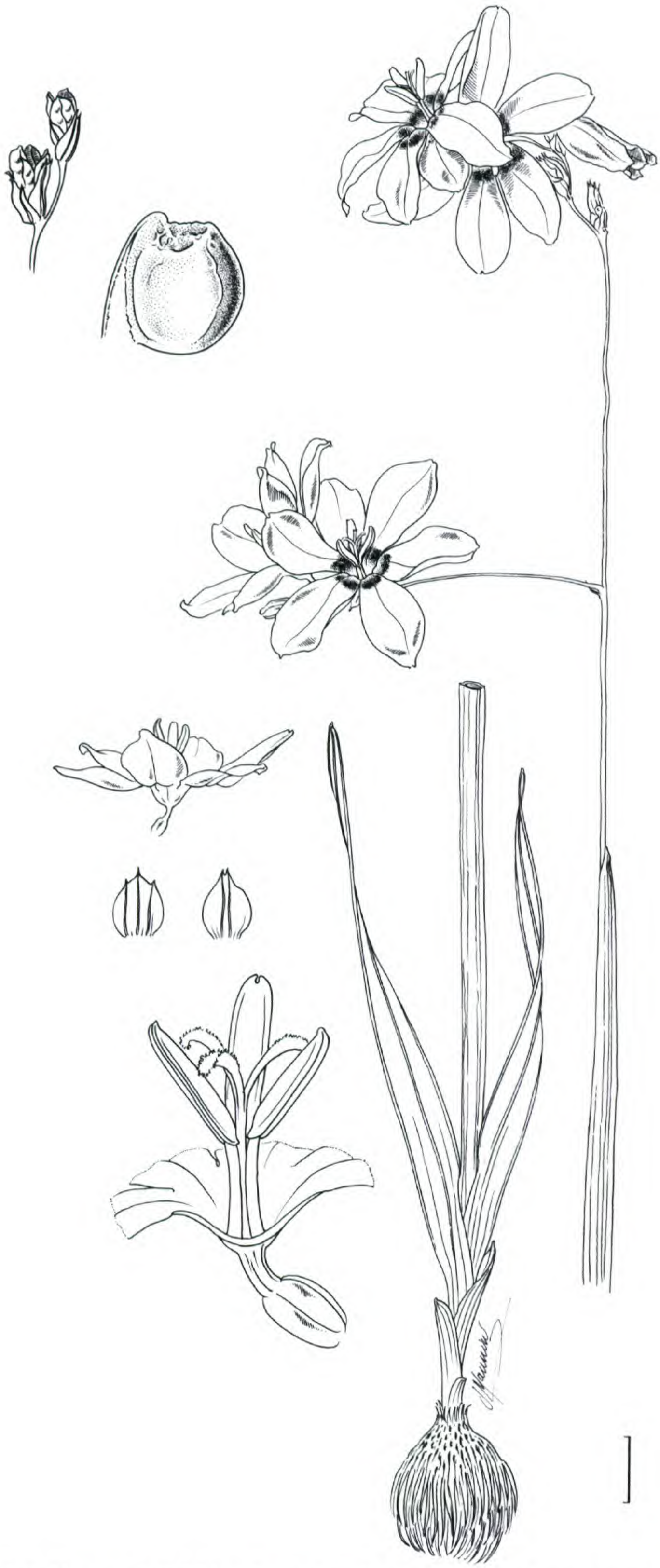

Figure 1. *Ixia superba* J. C. Manning & Goldblatt. Drawn from living plants from the type population, *Goldblatt & Porter 12180*, by John Manning. Scale bar 10 mm for entire plant, capsules, floral bracts, and side view of flower; detail of the perianth base, entire gynoecium and stamens of dissected flower, 3× scale bar, seed approximately 6× scale bar.

breve quam exteriore, floribus hypocrateriformibus actinomorphis pallide ad intense carneis tepalis purpureis ad basem nigris leviter dulce odoris, tubo perianthii pauce curvato cylindrico infime 2–3 mm abrupte expanso in cupulam ca. 3 mm profundam, tepalis obovatis patentibus subaequalibus (14–)18–22 × (6–)10–12 mm, filamentis conniventis 5–6 mm longis erectis nigris, antheris divergentibus 6–7 mm longis nigris, polline flavo, ovario ovoideo ca. 2 mm longo, stylo erecto furcato ad basem antherarum ramis 2–3 mm longis nigris, capsulis ovoideis 9–11 × 5 mm, seminibus subglobosis vel angulatis 1.2–1.5 mm diam. leviter rugosis.

Plants 20–60 cm high; corms globose, 15–20 mm diam., the tunics of medium to coarsely textured fibers; *cataphylls* membranous, the upper one reaching just above ground level and flushed reddish brown. *Leaves* 3, all basal, the lower two narrowly to broadly lanceolate, (3–)5–10 mm wide, usually about half as long as the stem, the margins and midribs moderately thickened, the uppermost leaf entirely sheathing, reaching at least to the middle or upper third of the stem. *Stem* erect, simple or 1- to 3-branched, 0.5–1 mm diam. at the base of the spike, branches held 45°–90° to the main axis; *spike* almost straight, the main spike usually 3- to 6-flowered, the lateral spikes 1- to 4-flowered; *bracts* membranous and translucent, the outer 8–10 mm long, with three light purple veins, lightly three-dentate, the inner as long as to slightly longer than the outer, forked at the apex, with two purple veins. *Flowers* salver-shaped, actinomorphic, pale to deep pink, the tepals each purple to blackish toward the base, lightly sweet scented; *perianth tube* slightly curved and cylindric for 2–3 mm, widening abruptly into a cup ca. 3 mm deep; *tepals* obovate, spreading at nearly right angles to the tube, subequal, (14–)18–22 × (6–)10–12 mm, the inner slightly wider than the outer; *filaments* inserted at the mouth of the narrow part of the tube, blocking the mouth, connivent, 5–6 mm long, straight and erect, black; *anthers* divergent, 6–7 mm long (before anthesis), black, the pollen yellow; *ovary* ovoid, ca. 2 mm long; *style* straight and erect, dividing opposite the base of the anthers, the branches arching outward, 2–3 mm long, black. *Capsules* ovoid, 9–11 × 5 mm; *seeds* subglobose or angled by pressure, 1.2–1.5 mm diam., yellow-brown, lightly wrinkled with surface cells colliculate.

Phenology. Flowering early to mid September, probably also in late August.

Etymology. From the Latin *superbus*, "superb, excellent," referring to the large, attractive, deep pink and purple-black flowers.

Distribution and biology. *Ixia superba* has a recorded range of just a few acres at the foot of the Langeberg in the Little Karoo east of Montagu. Plants grow on loamy sandstone ground that grades to a light clay at the interface of Table Mountain Sandstone and Bokkeveld Systems on the farm Klipheuwel. We collected plants in bloom there in early September 2002 close to the end of their flowering season. Associated plants were *Babiana patula* N. E. Brown, *Moraea gawleri* Sprengel, *Watsonia laccata* (Jacquin) Ker-Gawler (Iridaceae), and the shrub *Elytropappus rhinocerotis* (L. f.) Lessing. The flowers evidently have a bimodal pollination strategy that uses both hopliine scarab beetles (Scarabaeidae: Hopliini) and worker honey bees, *Apis mellifera* (and possibly female bees of other genera). The flowers have the typical attributes of the hopliine beetle pollination system, viz. a brightly colored perianth with dark markings, darkly pigmented stamens, relatively long anthers, and short style branches. The closed perianth tube and absence of nectar are also features associated with this pollination system in *Ixia* (Goldblatt et al., 2000a). Presence of a sweet floral odor is, however, an attribute of bee pollination and bees do visit the flowers, which evidently last three days, but close at night. Both hopliine beetles and honey bees were found visiting the flowers, the latter actively collecting pollen. Early in the morning hopliine beetles were found in half-closed flowers in which they had evidently spent the night. In one other collection of *I. superba* we have found (*Steiner 3239*, NBG), field notes indicate that the flowers were visited by the hopliine beetle *Peritrichia* sp.

Relationships. *Ixia superba* is readily confused with a second Little Karoo species, *Ixia gloriosa* G. J. Lewis (1962). Although both have deep pink flowers with a large blackish glossy central eye and blackish filaments and anthers, there are several important floral differences between them. The darker red-purple flowers of *I. gloriosa* have relatively short, slightly spreading filaments 3–5 mm long, and anthers, said by de Vos (1999b) to be 6–7 mm long and connivent at the tips. Plants studied by us alive (*Goldblatt, Manning & Porter 12179*, MO, NBG), however, had anthers ca. 4.5 mm long diverging throughout, thus not apically connivent. The style normally divides at the mouth of the tube, thus opposite the base of the filaments, and the style branches are ca. 4 mm long. The perianth tube is 4–7 mm long and widens abruptly into a small cup little more than 1 mm deep. Fresh flowers of *I. gloriosa* have a characteristic umbonate appearance, the result of the tepals being raised above the rim of the perianth cup before spreading. This is not apparent in pressed specimens or closed flowers. In contrast, *I. superba* has the perianth tube slender below for 3

mm, widening abruptly into a cup ca. 3 mm deep and the tepals spread uniformly from the rim of the tube. The filaments are 5–6 mm long, and the divergent anthers are ca. 6 mm long. The style is enclosed above by the closely connivent filaments and divides at or shortly above the top of the filaments into shorter style branches 2–3 mm long. In addition, *I. gloriosa* typically has linear leaves 15–55 × 1–3 mm and a long slender spike of 8 to 10 flowers on the main axis, whereas *I. superba* has shorter, lanceolate leaves 10–30 × (3–)5–10 mm and a shorter, crowded spike of 3 to 6 flowers. While the bracts of the two species are similar, those of *I. gloriosa* have more pronounced veins that when dry remain dark purple, while the veins in the bracts of *I. superba* fade and almost disappear.

There are several other locally endemic species of *Ixia* in the Breede River valley that resemble one another closely in their deep pink flowers with a dark center and blackish filaments and anthers (Lewis, 1962). This flower type is adapted for pollination by hopliine beetles, a pollination system that seems to favor local differentiation among plant species, e.g., *Aristea* subg. *Pseudaristea* (Goldblatt & Manning, 1997) and *Sparaxis* (Goldblatt et al., 2000b). The species of *Ixia* in the Breede River valley with flowers adapted for this pollination system form a geographical series, replacing one another across relatively short distances. Moving down the river valley from its head in the northwest, the series comprises *I. vinacea* G. J. Lewis (Tulbagh), *I. rouxii* G. J. Lewis (Wolseley), *I. mostertii* M. P. de Vos (Romans River to Worcester), *I. vanzyliae* L. Bolus (Worcester to Roberston), *I. atrandra* Goldblatt & J. C. Manning (south of Worcester to Stettyn), *I. superba* (Montagu), and *I. gloriosa* (Barrydale). Among this alliance, *I. superba* is readily distinguished by the perianth tube that forms a wide cup ca. 3 mm long in the upper half and the style that divides at or slightly above the base of the filaments, thus close to the base of the anthers, rather than at the mouth of the perianth tube and well below the base of the anthers.

Paratypes. SOUTH AFRICA. **Western Cape:** 3320 (Montagu), Farm Rietvlei No. 1, ca. 10.5 km SE of Montagu, scattered on S-facing rocky slope (CC), ca. 370 m, 5 Sep. 1997, *Steiner 3239* (NBG); Scheepers Rust, 20 mi. E of Montagu, 22 Aug. 1936, *Martley s.n.* (BOL 26930).

Tritonia delpierrei M. P. de Vos, J. S. African Bot. 49: 403. 1983. *Tritonia marlothii* subsp. *delpierrei* (M. P. de Vos) M. P. de Vos, Fl. S. Africa 7(2,1): 121. 1999. TYPE: South Africa. Northern Cape: Richtersveld, top of Helskloof, *M. P. de Vos 2462* (type, STE).

We do not accept de Vos's (1999a) reduction of the South African *Tritonia delpierrei* to subspecific rank in *T. marlothii* M. P. de Vos. We have seen and examined both plants in the wild, and while they are evidently sister taxa, isolated geographically and phylogenetically within *Tritonia* (de Vos, 1983), there is little overlap in their critical taxonomic features. We prefer to maintain them as separate species differing in floral coloration and dimensions that apparently indicate different primary pollinators. *Tritonia delpierrei* has lightly sweet-scented, pale yellow flowers, the lower tepals with cream markings, a perianth tube 12–22 mm long, and the dorsal tepal 8–12 mm long. In contrast, *T. marlothii* has odorless flowers, a pale to deep purple perianth (not lilac as indicated by de Vos) with the lower tepals yellow with purple tips and a median dark violet spot, and new collections (e.g., *Goldblatt & Porter 11757*, MO, NBG) show the perianth tube is 28–42 mm long and the dorsal tepal (8–)10–12 mm long. The flowers of *T. marlothii* show the stereotyped adaptations for pollination by the long-proboscid fly *Prosoeca peringueyi* (Manning & Goldblatt, 1996), and we have captured this fly while visiting and evidently pollinating the flowers (unpublished obs.). The shorter perianth tube of *T. delpierrei* suggests pollination by a long-tongued anthophorine bee. The ranges of the two taxa largely overlap. *Tritonia marlothii* occurs in the southern Richtersveld of Namaqualand at Brakfontein, southwest of Eksteenfontein, and along the eastern foothills of the Stinkfontein Mountains north of Eksteenfontein, whereas *T. delpierrei* extends from near Eksteenfontein in the south to Helskloof in the north, a distance of some 60 km that includes a large part of the range of *T. marlothii.* While *T. delpierrei* seems to favor sandy slopes, we have only seen *T. marlothii* in rocky ground, an apparent habitat difference also consistent with separate species status.

Thus despite their evident immediate relationship, we see no reason to consider *Tritonia delpierrei* as a subspecies of *T. marlothii.* Their geographic ranges partly overlap while their habitats differ, and their critical morphological features show no evidence of convergence.

IRIDOIDEAE

Ferraria kamiesbergensis M. P. de Vos, J. S. African Bot. 45: 362. 1979. TYPE: South Africa. Northern Cape: Rondefontein, 1 Sep. 1976, *E. G. H. Oliver 5970* (lectotype, here designated, lower left plant on sheet, STE).

Described by M. P. de Vos in 1979, *Ferraria ka-*

miesbergensis is represented by four elements: the illustration accompanying the protologue (de Vos, 1979: 363), and three plants mounted on a single sheet, *Oliver 5970*. These were evidently all collected on the same date at Rondefontein in the Kamiesberg of central Namaqualand. We have visited the type locality (or as close to it as is possible) and found a small, uniform population of plants with small pale yellow flowers, stems 12–15 cm high, branching if at all, only from near the base, with distinctive dark green leaves, and subequal inflorescence spathes (*Goldblatt & Porter 12223*, MO, NBG). Most significantly, the lower leaves all curve inward in the same direction.

Only one specimen on the type sheet matches these plants, and it also has the paired inflorescence spathes almost equal in length with the inner sheathing only below. The other two plants are taller (one is ca. 30 cm tall), have narrower, evidently flat leaves, produce branches well above ground level, and the outer inflorescence spathes are about half as long as the inner and are largely sheathing. The plant illustrated in the protologue corresponds to the larger of these two taller specimens, and both appear to be a second species, possibly what is currently called *Ferraria divaricata* Sweet, either its subspecies *aurea* M. P. de Vos or subspecies *arenosa* M. P. de Vos. The flower illustrated is probably *F. kamiesmontana* (and is certainly not *F. divaricata*), while the smaller plant on the lower left of the type sheet alone matches plants in the wild and is the lectotype.

The plants found at Rondefontein are matched at other sites in the southern Kamiesberg on the farm Karas, to the north, immediately adjacent to Rondefontein. Elsewhere on the Kamiesberg, the only other pale yellow-flowered species of the genus is the florally nearly identical *Ferraria macrochlamys* (treated by de Vos as *F. uncinata* subsp. *macrochlamys*, see below), which has quite different leaves.

The range of *Ferraria kamiesbergensis* according to de Vos is from Springbok (*Thompson 1301*, NBG) in the north to Wallekraal in the southwest (*Compton 5405*, BOL), and extending east as far as the Calvinia district (e.g., *de Vos 2347*, NBG). We have examined all the specimens on which de Vos based her assessment of the range of the species and consider them to correspond with what she called *F. divaricata*. None of the specimens she cited have the distinctive incurved leaves and subequal spathes of the southern Kamiesberg populations (flower color can no longer be determined). As circumscribed here, *F. kamiesbergensis* is restricted to the southern Kamiesberg at elevations above 1000 m where plants matching the lectotype occur.

Ferraria macrochlamys (Baker) Goldblatt & J. C. Manning, comb. nov. Basionym: *Lapeirousia macrochlamys* Baker, J. Bot. new ser. 5: 338. 1876. *Ferraria uncinata* subsp. *macrochlamys* (Baker) M. P. de Vos, J. S. African Bot. 45: 369. 1979. TYPE: South Africa. Namaqualand, without precise locality or date, Herb. Forsyth s.n. [probably collected by J. Niven in 1899] (type, K).

In her revision of *Ferraria* (Iridoideae) de Vos (1979) treated a series of central and northern Namaqualand populations (Northern Cape, South Africa) with pale yellow flowers as *F. uncinata* subsp. *macrochlamys*, while she regarded Western Cape populations with deep blue to violet flowers as *F. uncinata* Sweet subsp. *uncinata*. De Vos believed that subspecies *macrochlamys* merited subspecific status because it differed only in having flowers with a differently colored perianth. The two taxa share with *F. brevifolia* G. J. Lewis and *F. kamiesbergensis* M. P. de Vos a distinctive flower type in the genus in which the tepal claws are suberect and collectively form a narrow floral cup that contains relatively dilute nectar. Both these latter species also have predominantly pale yellow tepals virtually the same shade and size as those of subspecies *macrochlamys*. De Vos regarded *F. macrochlamys* and *F. uncinata* as sharing similar leaf blades with the margins thickened and the edges crisped and often undulate. In her key (1979: 329) to the species, *F. uncinata* (including subsp. *macrochlamys*) is distinguished by "margins of at least some of the foliage leaves crisped." De Vos commented of subspecies *macrochlamys* and subspecies *uncinata* that they "differ only in flower coloring and geographic distribution." Closer examination of specimens she included in subspecies *macrochlamys*, however, shows that the thickened, hyaline part of the leaf margins is crenate to lightly serrate and sometimes shortly velvety, but the leaf edges themselves are only occasionally lightly crisped. In *Ferraria uncinata* the thickened part of the leaf margin may be entire, or sometimes lightly serrated or crispulate, and not velvety but rather evidently smooth (but under 10× magnification papillate), while the edges of at least some of the leaves are crisped and usually undulate. Thus, examination of the leaf margins alone can usually distinguish the two taxa. In addition, the flowers of *F. uncinata* have outer tepals (18–)30–35 mm long, with claws 9–11 mm long, thus usually slightly less than one-third the

length of the entire tepal. In *F. uncinata* subsp. *macrochlamys* the outer tepals are 24–28 mm long and the claws 12.5–14 mm long, thus half as long as the entire tepal.

We believe the differences are sufficient that *Ferraria uncinata* subsp. *macrochlamys* should be treated as a separate species. In fact, we are not convinced that it is most closely related to *F. uncinata.* The central Namaqualand *F. kamiesmontana* has flowers virtually identical to those of *F. uncinata* subsp. *macrochlamys* in size, proportion, and orientation, as well as color, and can be distinguished from the subspecies solely by a few dark spots at the bases of the outer tepal limbs. Leaf margins of *F. kamiesmontana* are, however, entire, smooth, and barely thickened. Growth form of the two is similar: plants of both taxa are low growing and have a few subequal branches near the stem apex, whereas *F. uncinata* subsp. *uncinata* often branches above the base, is frequently taller, and the stems emerge from the leaf sheaths. Relationships of *F. uncinata* subsp. *macrochlamys* are by no means obvious, and it is most useful to treat it as a separate species, pending phylogenetic analysis of *Ferraria* using molecular techniques.

Regarding the type collection of *Ferraria macrochlamys*, the specimen bears the annotation "Forsyth 1835" suggesting a gathering by a Mr. Forsyth. No collector of this name in known in southern Africa, and the name Forsyth, listed by Gunn and Codd (1981) in their compilation of plant collecting in southern Africa, is without initials, dates of birth and death, and lacking additional information. We now believe the annotation refers to William Forsyth, son of W. F. Forsyth of the Chelsea Physic Garden, who maintained a herbarium collection. William Forsyth died in July 1835 and his library, presumably containing herbarium specimens, was auctioned in November of that year (C. Nelson, pers. comm.). Indications in the accounts of *Babiana spiralis* Baker, based on another Forsyth specimen (Baker, 1892, 1896), have led us to conclude that the Forsyth herbarium was purchased by Willam Banks, then Keeper of the Kew Herbarium, for the collection there. The most likely collector of the type of *B. spiralis* and *Ferraria macrochlamys* is the British botanist James Niven, who collected in Namaqualand in 1799 and later, and whose specimens are now widely dispersed (Gunn & Codd, 1981). The type citation above reflects this new information.

Moraea simplex Goldblatt & J. C. Manning, sp. nov. TYPE: South Africa. Western Cape: 21 km N of Piketberg, 18 Sep. 2002, *P. Goldblatt & L. J. Porter 12231* (holotype, NBG; isotypes, MO, PRE). Figure 2.

Plantae 28–40 cm altae, cormo ovoideo ca. 10 mm diametro tunicis reticulatis fibrosis brunneis obtecto, foliis productis 1 canaliculatis 2–3 mm latis, caule perramoso, spatha interne inflorescentiis 18–22 mm longis, floribus flavo-cremeis, tepalorum limbis leviter reflexis unguibus ascendentibus ca. 2 mm longis, limbis externis 18–20 × 7.5–8.5 mm internis ca. 18 × 7 mm, filamentis liberis ca. 5 mm longis inferne in columnam gracilem conniventibus superne per 1 mm divergentibus, antheris albis ca. 3 mm longis, stylo ramis filiformibus indivisis ca. 4 mm longis inter filamenta arcuatis, ovario exserto anguste ovato ca. 3 mm longo.

Plants 28–40 cm high; *corm* ovoid, ca. 10 mm diam., the tunics of coarse, light brown fibers, with a neck of fairly fine fibers surrounding the base of the stem; *cataphylls* papery, the uppermost reaching shortly above the ground, becoming dry and light brown by flowering time, then often irregularly broken. *Foliage leaf* solitary, inserted on the first aerial node, the blade channeled, exceeding the stem, arching outward or trailing distally, 2–3 mm wide. *Stem* erect, lightly flexuose, sticky below the nodes for half the length of an internode, bearing a sheathing bract-like leaf at each of the upper nodes, these 24–35 mm long, green, becoming dry and light brown above, the apices acute, bearing two or three short branches of one internode each at the upper three or four nodes, branches at the lower nodes sometimes two internodes long and also branched, the branches erect and parallel to the stem below, flexed outward above the sheathing leaf. *Inflorescence* a rhipidium, terminal on the branches, several-flowered; *spathes* subequal, green, with dry, brown tips, 18–22 mm long, the outer slightly shorter than the inner. *Flowers* uniformly pale creamy yellow, the outer tepals each with a pale yellow mark at the base of the limb, unscented, the tepal claws ascending, forming a cup enclosing the base of the filaments; *tepals* clawed, the outer slightly larger than the inner, the claws ascending, ca. 2 mm long, the limbs ovate, obtuse, initially spreading horizontally, later dipping up to 30° below the horizontal, the outer 18–20 × 7.5–8.5 mm, the inner ca. 18 × 7 mm; *filaments* ca. 5 mm long, free but connivent below and forming a slender column, diverging in the upper 1 mm; *anthers* ca. 3 mm long, oblong, appressed to one another, white, the pollen white; *ovary* exserted, narrowly ovoid, ca. 3 mm long; *style* dividing shortly below the base of the anthers into 3 filiform branches, each stigmatic apically and extended between the filaments, ca. 4 mm long. *Capsules* and *seeds* unknown.

Figure 2. *Moraea simplex* Goldblatt & J. C. Manning. Drawn from living plants from the type population, *Goldblatt & Porter 12231*, by John Manning. Scale bar 10 mm for entire plant, side view of stamens and style branches approximately 3× scale bar.

Phenology. Flowering in mid to late September, probably into mid October.

Etymology. From the Latin *simplex*, "unadorned, plain," referring both to the pale-colored flowers without markings, the spreading subequal tepals, and the filiform style branches lacking style crests.

Distribution and biology. Moraea simplex is known only from the relatively moist clay flats at the eastern foot of the Piketberg Mountains. Numerous plants were found at the beginning of their flowering or still in bud on September 18 at the single known site for the species, which had been burned the previous summer. We infer that flowering continues until at least early October. The flowers each last a single afternoon, opening at about 14:00H and wilting shortly after nightfall.

Relationships. The seventh member of the taxonomically isolated subgenus *Visciramosa* (Goldblatt, 1986; Goldblatt & Manning, 2000b), *Moraea simplex* has the typical attributes of the subgenus, including sticky internodes, multiple leaves, branched stems, relatively short inflorescence spathes, and free, connivent filaments. Plants are readily mistaken for the common and widespread *M. inconspicua* Goldblatt in the vegetative state as both species share narrow leaves, short, subequal rhipidial spathes, and relatively small flowers. However, *M. inconspicua* usually has two foliage leaves, unequal tepals, the outer larger than the inner, the tepal limbs strongly reflexed, and relatively broad, flattened style branches with paired erect crests, and the anthers appressed to the opposed style branches, the latter condition typical of the genus. In contrast, *M. simplex* has solitary foliage leaves, the inner and outer tepals nearly equal in size and spreading to slightly dipping below the horizontal, and simple, filiform style branches that extend between the filaments.

That the species belongs in *Moraea* cannot be doubted despite the unusual filiform style branches that extend between the filaments, for the resemblance to other species of subgenus *Visciramosa* is striking. It has firm, channeled leaves, sticky nodes and internodes, and the distinctive lateral branching pattern in which the branch axis is parallel to the main stem below, before arching outward almost horizontally above the sheathing bract, but with the rhipidia held erect, and the subequal, obtuse rhipidial spathes of the subgenus. Only the flowers are discordant, not only with the subgenus, but with *Moraea* in general. Reduced style branches, not or hardly wider than the anthers they subtend, are relatively common in *Moraea* and were the hallmark of the genus *Homeria* (Goldblatt, 1981), now included in *Moraea* (Goldblatt, 1998; Goldblatt et al., 2002). Even in *Homeria*, however, the style branches have forked apices and lie opposite the stamens and appressed to the anthers. Completely undivided style branches, not opposed to the stamens, were the feature that distinguished *Roggeveldia* (Goldblatt, 1979). The two species of *Roggeveldia* are now also included in *Moraea* (Goldblatt, 1998) and are most probably related to *Moraea crispa* Thunberg and its immediate allies (Goldblatt, 1986). Thus the filiform, undivided style branches held alternate to the stamens are a parallel development in a second lineage of *Moraea*. Discovery and description of *Moraea simplex* brings the number of species in the genus to 197 (Goldblatt & Manning, 2002).

In *Moraea* the following combinations at subspecies rank were inadvertently not made when species of *Hexaglottis* and *Homeria* were transferred to that genus (Goldblatt, 1998).

Moraea bulbillifera subsp. **anomala** (Goldblatt) Goldblatt, comb. nov. Basionym: *Homeria bulbillifera* subsp. *anomala* Goldblatt, Ann. Missouri Bot. Gard. 68: 458. 1981. TYPE: South Africa. Western Cape: Witsands near Ossekop, *P. Goldblatt 4885* (holotype, MO; isotypes, BR, K, NBG, PRE, WAG).

Representative specimen. SOUTH AFRICA. **Western Cape:** 3321 (Ladismith) Cloete's Pass to Wagenbooms (DD), Sep. 1976, *Goldblatt 4157* (K, MO, PRE, S, WAG).

Moraea lewisiae subsp. **secunda** (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis lewisiae* subsp. *secunda* Goldblatt, Ann. Missouri Bot. Gard. 74: 558. 1987. TYPE: South Africa. Northern Cape: near the top of Spektakel Pass, *P. Goldblatt 6673* (holotype, PRE; isotypes, K, MO, NBG, S, US, WAG).

Representative specimen. SOUTH AFRICA. **Northern Cape:** 3119 (Calvinia) Nieuwoudtville, karroid hills NE of Klipkoppies (AC), Sep. 1981, *Goldblatt 7073* (MO).

Moraea virgata subsp. **karooica** (Goldblatt) Goldblatt, comb. nov. Basionym: *Hexaglottis virgata* subsp. *karooica* Goldblatt, Ann. Missouri Bot. Gard. 74: 568. 1987. TYPE: South Africa. Northern Cape: 22 km W of Middelpos, *D. Snijman 765* (holotype, NBG; isotypes, K, MO, PRE).

Representative specimen. SOUTH AFRICA. **Northern Cape:** 3120 (Williston) Roggeveld Escarpment, 71 mi. SE of Calvinia on Middelpos road via Blomfontein (CC), Sep. 1981, *Goldblatt 4621* (MO, NBG).

NIVENIOIDEAE

Aristea torulosa Klatt, Abh. Naturf. Ges. Halle 15: 382. 1882. TYPE: South Africa. Eastern Cape: Transkei, betw. Gekau & Bashee, Dec. 1832, *J. F. Drège 4558* (lectotype, effectively designated by Weimarck (1949: 27), B not seen, photo, K; isotype, P).

Aristea torulosa var. *monostachya* Baker, Fl. Cap. 6: 49. 1896. TYPE: South Africa. Natal, without precise locality or date, *Buchanan s.n.* (type, K).

Aristea woodii N. E. Brown, Kew Bull. 1931: 192. 1931. Syn. nov. TYPE: South Africa. KwaZulu-Natal, Inanda, *J. M. Wood* 757 (type, K).

Aristea torulosa has been overlooked in recent times, and Vincent (1985) excluded the species from his account of *Aristea* in eastern southern Africa because he considered that no specimens could be assigned to it. J. G. Baker (1896) and Weimarck (1940), however, had no misgivings about its identity and status, and Baker (1896) actually regarded what was later described as *A. woodii* as *A. torulosa* var. *monostachya* Baker. *Aristea woodii* and *A. torulosa* have identical derived, relatively large rhipidial spathes and bracts that are dark green below, aging reddish brown, that grade unevenly into broad translucent margins, darker along the veins thus giving them a feathered appearance. The pale edges of the spathes and bracts become torn and irregularly fringed with age.

The only significant difference between plants assigned to *Aristea woodii* and the type of *A. torulosa* is the crowded flowering axis of the latter, which has the lower nodes bearing short lateral branches. Typical *A. woodii* has a more slender flowering stem usually bearing only sessile flower clusters. Plants readily referable to *A. woodii* may, however, have one or even two of the lowermost nodes bearing stalked flower clusters; thus, in effect, the flowering stem is branched. The type of a second species, regarded as a synonym of *A. torulosa* by Weimarck (1940) but excluded by Vincent (1985), *A. congesta*, described by N. E. Brown in 1931 and based on plants from the Transkei, South Africa, is just such a plant, and we see no reason to distinguish it from *A. woodii*. The more congested floral axis of *A. congesta* in turn, is little different from that of *A. torulosa*. Plants similar to the types of *A. congesta* and *A. torulosa* are matched by *Krauss s.n.* (K) from Port Natal and *Rehmann s.n.* (K) from Woodbush in Limpopo Province. The Krauss collection was referred by Weimarck to *A. torulosa*, while the Rehmann collection was not cited by either Weimarck (1940) or Vincent (1985). More extensive collections now available, at NBG, MO, and PRE, suggest that all three named species represent single taxon. The earliest name for this widespread species that extends from Tanzania and eastern Angola (Goldblatt, 1993, 1996) in the north to eastern South Africa in the south thus becomes *A. torulosa*.

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Tradescantia boliviana (Commelinaceae), a New Combination for an Overlooked South American Species

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ABSTRACT. The new combination *Tradescantia boliviana* (Hasskarl) J. R. Grant is made in recognition that it is a distinct species widespread in Peru, Bolivia, Paraguay, and Argentina, here separated by morphological characters and distribution from its previous inclusion within *T. ambigua* Martius ex J. H. Schultes, which is restricted to northeastern Brazil.

Key words: Argentina, Bolivia, Brazil, *Mandonia*, Paraguay, Peru, *Tradescantia*.

While researching the *Tradescantia* sect. *Mandonia* complex, problems in species limits and nomenclature were discovered in the non-Mexican species. A new combination is proposed as *Tradescantia boliviana* (Hasskarl) J. R. Grant in recognition that the material from Peru, Bolivia, Paraguay, and Argentina represents a distinct species. This species is here separated from synonymy under *T. ambigua* Martius ex J. H. Schultes, which is restricted to northeastern Brazil.

Ten species comprise *Tradescantia* sect. *Mandonia* D. Hunt. The group has a center of diversity in Mexico with six species: *T. burchii* D. Hunt [found in Jalisco], *T. crassifolia* Cavanilles (including *T. acaulis* Martens & Galeotti and *T. iridescens* Lindley) [northern Mexico to Guatemala], *T. exaltata* D. Hunt [Oaxaca], *T. llamasii* Matuda [Est. México], *T. peninsularis* Brandegee [Baja California], and *T. tepoxtlana* Matuda [Morelos] (Hunt, 1980, 1986). Four non-Mexican species range from Guatemala to South America: *T. ambigua* Martius [distributed in northeastern Brazil], *T. boliviana* (Hasskarl) J. R. Grant [Argentina, Bolivia, Paraguay, Peru], *T. petricola* J. R. Grant [Costa Rica, Venezuela] (Grant, 2000), and *T. velutina* Kunth & C. D. Bouché [Guatemala, Honduras, and Nicaragua].

While researching *Tradescantia petricola*, additional specimens were located from Venezuela that matched this previously envisioned Costa Rican endemic (Grant, 2000). While further searching among South American indets and among *T. ambigua* in many herbaria (COL, G, GH, IAN, INPA, L, MG, MO, NY, P, R, RB, SP, SPF, and US), it became evident based on plant size, leaf disposition, sepals, and distribution that the specimens from Peru, Bolivia, Paraguay, and Argentina were clearly different from those from Brazil. While it was initially thought that these represented a new species, the name *Mandonia boliviana* was found to apply. Type material of *Mandonia boliviana* was located at Leiden (L, 1 sheet), Paris (P, 3 sheets), and Geneva (G, 2 sheets), and its lectotypification is proposed below. Examination of this type material, and comparison to recently collected specimens, clarifies its identity as distinct from *T. ambigua*. Since the combination into *Tradescantia* has not been made, the new combination is proposed here.

Tradescantia ambigua is restricted to the caatinga of northeastern Brazil, while *Tradescantia boliviana* is restricted to the Gran Chaco of Argentina, Bolivia, Paraguay, and Peru (Fig. 1).

Tradescantia boliviana (Hasskarl) J. R. Grant, comb. nov. Basionym: *Mandonia boliviana* Hasskarl, Flora 54: 260. 1871. *Skofitzia boliviana* (Hasskarl) Hasskarl & Kanitz, Oesterr. Bot. Z. 22: 147. 1872. TYPE: Bolivia. Larecaja: "Viciniis Sorata montis colles Ullontigi ad scopulorum radicem in regione temperata," 2700 m, Feb.–Apr. 1858, *G. Mandon 1239* (lectotype, designated here, L [Herb. J. K. Hasskarl]; isotypes, G [2], K not seen, P, P [originally from 'Herb. E. Cossen'], P [originally from 'Herbier E. Drake']).

Specimens examined. ARGENTINA. **Córdoba:** [entre Panolma y la Villa del Transito (P)], [zwischen Panolma unter der Villa del Transito und der Westseite der Tierra Achala de Cordoba (US)], 23 Feb. 1876, *Hieronymus s.n.* (P, US); Rodado, *Stuckert 10938* (G); Sierra Cleica de Cordoba, *Stuckert 13530* (G), *Lossen 450* (GH); Punilla, Capilla del Monte, *Cuezzo & Balegno 2144* (G, US). **Salta:** M. Sala, *Venturi 8180* (GH, US); Cerro San Bernardo, Salta, W [no collector?] *6151* (GH); Orán, Pintascayo, *Pierotti 6558* (G); Cachi, Quebrada de Escoipe, Ruta 30, 2 km

Figure 1. Distribution of *Tradescantia boliviana* in open circles, and *T. ambigua* in solid squares.

antes de El Maray, *Novara 6067* (G); Rosario de Lerma, Quebrada del Rio Blanco, 2–3 km al SW (aguas arriba) del rio Toro, *Novara 7603* (G [3]). **Tucumán:** Capital, Dunaquito, *Venturi 1669* (GH, US), *Venturi 1669a* (GH, US); Tufi del Valle, *Venturi 2921* (GH, US). BOLIVIA. **Chuquisaca:** Tomina, *Weddell 3839* (P). **Cochabamba:** near Taquina, above Cochabamba, *Everdam 25231* (G); Cochabamba, *Julio II.174* (NY, US), *Cárdenas 5569* (US); Camino a Sacabe, cerca a Cochabamba, *Ochoa 670* (NY); Cercado de Cochabamba, la Colina de San Pedro, *Steinbach s.n.* (US); Campero, Mique, *Steinbach 755* (GH, NY, US); Cerro San Pedro, behind Cochabamba, *Cutler & Cardenas 3839* (GH); Panduro, near Rio Caine-Cochabamba, *Cárdenas 2484* (US). **La Paz:** Sud Yungas, "Ridge of Pasto Grande," on the ridge between Río La Paz Río Jucumarini, ca. 10–12 km up river from La Plazuela Bridge, *Lewis 37176* (US). **Santa Cruz:** Prov. Cordillera, Alto Parapetí, *Michel 127* (US); Nuflo de Chavez, Estancia San Miguelito, *Fuentes 1547* (US). **Tarija:** Tarija, *Fiebrig 2623* (G). **Without province:** Arampampa, Potosin, *Cárdenas 5889* (US). PARAGUAY. **Chaco:** Mayor Pedro Lagerenza, *Schinini & Bordas 15009* (G). **Cordillera:** In calle Tobaty, *Hassler 4016* (G [2; The sheet # is included as [2], just sheet(s) is deleted.]); Cordillera de Altos, Co. de Tobatí, *Schinini 23949* (G); Cerro Tobotí, *Degen 731* (G); Tobotí, Cerro Tobotí, a 2 km de la ciudad, *Degen 777a* (G [3]); Cobratí, Cerro Llytu Silla, a 2 km al sur de la ciudad, *Deger et al. 777b* (G); Tobotí, "Ybytú Silla" mesa, *Zardini & Valázquez 27437* (US); Cordillera de Altos, *Fiebrig 960* (G [3], GH, P, US); "Paraguaria centralis, propre Sapucay/ Ypacaray," *Hassler 12489* (G [2], GH, US). **Gran Chaco:** Santa Elisa, *Rojas 2807* (G, P). **Guairá:** Villarrica, *Mereles 2287* (G). **Nueva Asunción:** Fortín Tte. Enciso, ruta Trans-Chaco, *Schinini & Borda 16496* (G). **Without province:** Orillas y mont cordilleras, *Hassler 2189* (G). PERU. **Huancavelica:** Tayacaja, Valley of the Mantaro, below Surcubamba, *Weberbauer 6495* (GH, US).

The name *Tradescantia ambigua* var. "glabra"

Hassler is annotated in Hassler's handwriting on several Geneva sheets, notably his apparent intended type *Rojas 2807*. It appears that this name has never been published, yet is nevertheless accounted for here to document history. Additionally, the name "Tradescantia breviaristata Hassl. form. nov. angustifolia Hassler" is annotated on a duplicate of *Rojas 2807* at Paris. Both the specific epithet "breviaristata" and the form name "angustifolia" appear to have never been published.

Barreto (1997) provided a treatment of the Commelinaceae in Brazil, including description and discussion of *Tradescantia ambigua*, and recognized no infraspecific taxa. She placed two varieties into synonymy, *T. ambigua* var. *glabriuscula* C. B. Clarke (1881) and *T. ambigua* var. *pilosula* Hoehne (1915). Neither of these names applies to *T. boliviana*.

KEY TO DIFFERENTIATE *TRADESCANTIA AMBIGUA* AND *T. BOLIVIANA* IN SOUTH AMERICA

1a. Plants robust, the stems to 8–9 mm wide; leaves densely pilose on both surfaces, the pubescence similar to that of the inflorescences, laterally spreading to slightly erect but never decurrent; inflorescences compact along short internodes (to 1.5–3 cm); sepals 7–9 mm long; Brazil . . . . . *Tradescantia ambigua*

1b. Plants slender, the stems to 3–5(–8) mm wide; leaves merely hirsute, the trichomes much shorter than those of the inflorescences, laterally spreading to erect or commonly decurrent; inflorescences remote (1.5–5 cm); sepals (5–)6–8 mm long; Peru, Bolivia, Paraguay, Argentina . . . . . *Tradescantia boliviana*

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Two New Species and a New Combination in South American Eriocaulaceae

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ABSTRACT. Described as new are *Eriocaulon huanchacanum*, a caulescent rheophyte endemic to Bolivia with capillary leaves and non-aerenchymatous roots, and *Syngonanthus dichroanthus* of Brazil and Bolivia, a rosulate annual with filiform leaves and staminate and pistillate flowers of contrasting colors. *Syngonanthus latifolius* of Mato Grosso, Brazil, based on *S. gracilis* var. *latifolius* Moldenke, is dimorphic both for flower color and size, and is here raised to species rank due to these previously undescribed characters.

Key words: Bolivia, Brazil, Eriocaulaceae, *Eriocaulon*, rheophyte, South America, *Syngonanthus*.

The Eriocaulaceae are a herbaceous monocotyledonous family of 10 genera and about 1200 species (Stützel, 1998), which typically occur on wet, acidic, nutrient-poor soils. Their center of diversity is in mountainous areas of the Precambrian shields in Venezuela and Minas Gerais, Brazil, but the Amazon Basin and Central Plateau of Brazil and Bolivia also support interesting endemics, especially in the genera *Eriocaulon* and *Syngonanthus*.

Eriocaulon is a predominantly aquatic or amphibious genus, with most species rosulate and distinguished by subtle characters. The rheophyte *Eriocaulon huanchacanum*, here described from the isolated Serranía Huanchaca in Bolivia, is remarkably distinct due to its long stem, capillary leaves with broad, imbricate bases, and unusual root morphology.

The two closely related annual species of *Syngonanthus* here treated are exceptional in their staminate and pistillate flowers of contrasting colors. Both are found in wet valleys adjoining cerrado and are rarely collected.

Eriocaulon huanchacanum Hensold, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Velasco, Parque Nacional Noel Kempff M., Campamento Huanchaca, a 3.35 km en línea recta desde el campamento base hacia el Río Pauserna, 13°56′01″S, 60°49′39″W, 650 m, 22 May 1994 (fl), *L. Arroyo, Killeen, Mostacedo & Wellens 741* (holotype, MO; isotypes, F, NY, USZ not seen). Figure 1.

Herba aquatica caulescens; radices durae tortuosae substrato per pilos arcte adhaerentes; caules 10–25 cm longi decumbentes ubique foliosi, ad nodos radicantes. Folia capillacea atroviridia uninervia, 9–16 cm longa, 0.3 mm lata, vaginis abrupte ampliatis imbricatis, caulem obtegentibus. Inflorescentia solitaria terminalis; pedunculi 18–22 cm longi, 0.7–0.8 mm diametro; capitula 5 mm diametro; bracteae involucrales nigrae glabrae obovatae apice rotundatae. Flores trimeri; sepala nigra ca. 1.4–1.8 mm longa, albociliata, eis florum staminatorum liberis vel in spatha connatis; petala subaequalia; antherae nigrae.

Submerged caulescent aquatics of flowing water; roots brown, tortuose, corky in texture, non-compressible, not diaphragmed, not aerenchymatous, the middle cortex undifferentiated, ca. 0.3–0.6 mm diam., sparingly branched, adventitious at intervals along the decumbent base of the stem, with localized segments densely pubescent and adhering tightly to the substrate, otherwise glabrous; *stems* ca. 10–25 cm long, ca. 2 mm diam., decumbent and often branched below, ascending and uniformly leafy above, the villous pubescence concealed by the persistent leaf sheaths. *Leaves* capillaceous, subterete in cross section, ca. 9–16 cm long, 0.3 mm wide, glabrous, blackish and brittle when dry, one-veined, weakly fenestrate (with transverse diaphragms of chlorenchyma) only at the base, otherwise the chlorenchyma confined to a single bifacial palisade layer; leaf sheaths ca. 6–7 mm long, dark green along the midvein with pale margins, ranging from 1 mm wide and gradually narrowed to the blade (*Ritter 4408*) to up to 3 mm wide and abruptly constricted to the blade, the upper margin truncate to asymmetrically auriculate and sparingly short-ciliate, the margins of adjoining sheaths overlapping, chartaceous, completely enclosing the stem. *Inflorescences* solitary and terminal, suberect, emergent; peduncle sheaths 4–6 cm long, 1.6–1.7 mm wide, glabrous, lax, split down one side, white-costate, the costae broader toward base, the lamina obtuse to subtruncate, erose to dentate or lacerate; *peduncles* 18–22 cm long, 0.7–0.8 mm diam., glabrous, ca. 6-costate, with white costae and green

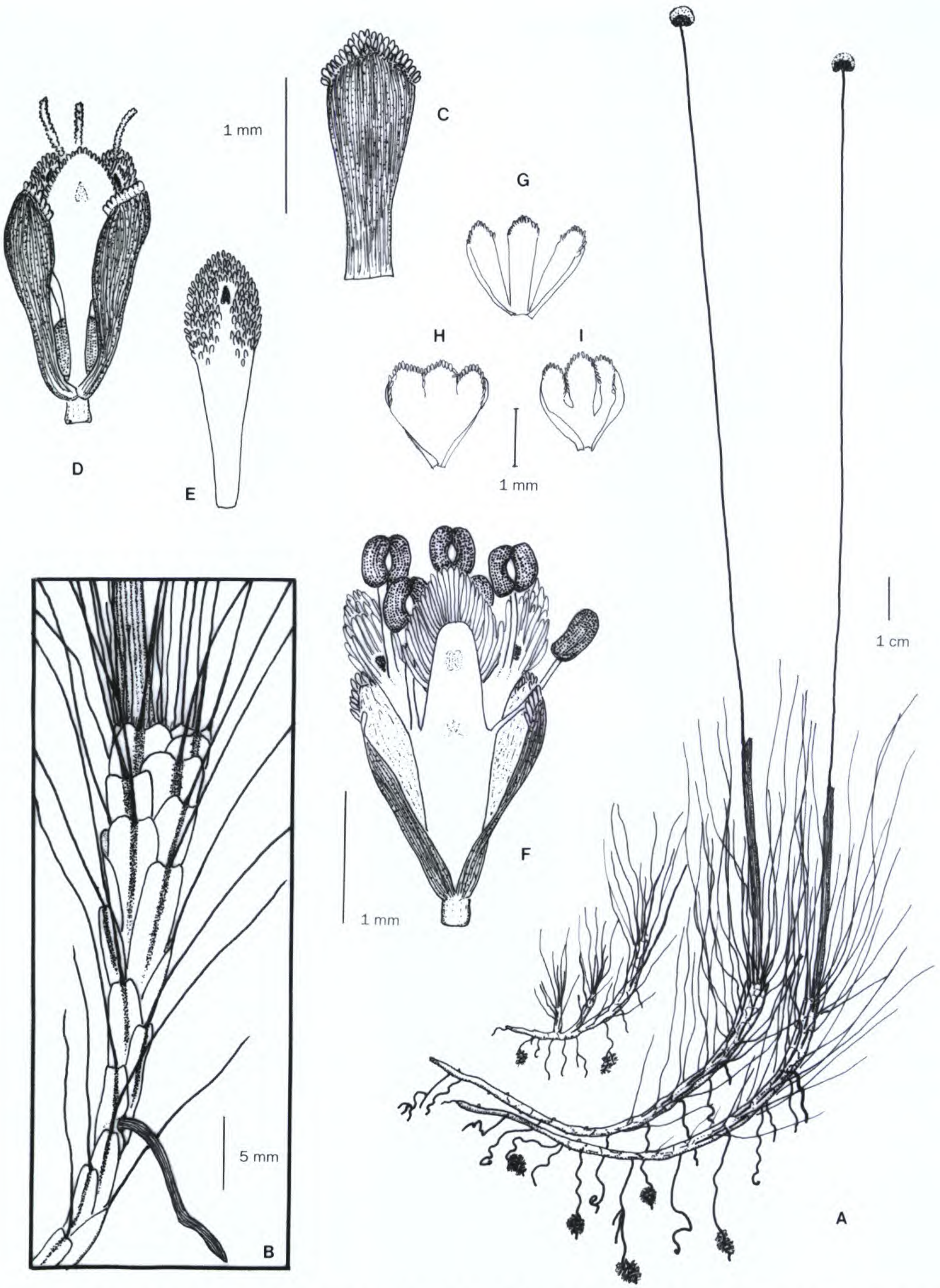

Figure 1. *Eriocaulon huanchacanum* Hensold. —A. Habit. —B. Detail of flowering stem apex showing imbricate leaf bases. —C. Receptacular bract. —D. Pistillate flower. —E. Petal of pistillate flower. —F. Staminate flower. —G–I. Variation in sepal fusion of staminate flower. Vouchers: A–E, H *Arroyo et al. 741*; F, I *Ritter et al. 4408*; G *Killeen et al. 7523*.

intercostae; *capitula* hemispheric, ca. 5 mm diam., the involucral bracts blackish brown, obovate, rounded at the apex, ca. 1.5 mm long, 0.9–1.0 mm wide, glabrous, thin and papery, lacerating with expansion of the head; involucre about equaling the capitulum; receptacular bracts blackish, broadly linear-spatulate, apiculate-rounded at apex, ca. 1.8 × 0.5–0.7 mm, equaling the flowers, tufted at upper margins and abaxially with milky white clavate trichomes ca. 0.15 mm long. *Staminate and pistillate flowers* 3-merous, the relative numbers of the two types varying between plants; *staminate flowers*: *sepals* 1.6–1.8 × 0.5–0.8 mm, blackened distally, broadly oblanceolate, the laterals slightly falcate-curved and cucullate, nearly free, or spathaceously fused to the inner (adaxial) sepal for up to ¾ of their length, the degree of fusion varying even within individuals, the upper margins bearded with white clavate trichomes; *petals* borne on a fleshy obconic stipe 1.2–1.4 mm long, obtuse-triangular, subequal, 0.65–1.1 × 0.4–0.75 mm at middle, exserted from calyx, bearing a thick tuft of white clavate trichomes ca. 0.4–0.5 mm long at the upper margin and submarginally within in the distal half, conspicuously black-glandular adaxially just below the apex; the gland squarish or bilobed and up to 0.2 mm diam.; stamens 6, the outer whorl with filaments free, ca. 1 mm long, the inner whorl with filaments ca. 1.25–1.4 mm long, the lower portion adnate to the petals below the gland; anthers exserted, black, 0.4–0.45 mm long; pollen black; *pistillate flowers*: *sepals* free, oblong to oblanceolate, rounded at apex, the laterals slightly cucullate-keeled, 1.4–1.5 × 0.5–0.75 mm, blackish, pubescence as in staminate flowers; *petals* free, oblanceolate-spatulate, narrowed at base, 1.8–1.9 × 0.5–0.6 mm, exserted, the black subapical gland prominent and conical, densely pubescent with short white clavate trichomes at upper margin and adaxially in the upper third, surrounding the gland; ovary short-stipitate (the stipe sometimes occurring between the petals and sepals), the style branches ca. 1.4 mm long, well-exserted at anthesis. Seeds not seen.

Phenology. Collected in flower from May to July.

Ecology and distribution. Known only from the Serranía Huanchaca (Capuruch) in northern Santa Cruz, Bolivia, near the border with Mato Grosso, Brazil, at 230–650 m. It occurs as a submerged aquatic with emergent capitula, in rapidly flowing water, probably limited to permanent watercourses.

Eriocaulon huanchacanum is a highly distinct species characterized by its submerged rheophytic habit, capillaceous subterete single-veined leaves fenestrate only very weakly at the base, scale-like imbricate leaf bases, and a long slender decumbent stem anchored along its length by tortuose brown roots.

Roots of this type have not previously been reported in *Eriocaulon*. Spongy white aerenchymatous roots, usually lacking root hairs, and with a unique, visibly diaphragmed structure (i.e., transverse diaphragms of stellate parenchyma alternating with a radially arranged, lamelliform aerenchyma) are virtually diagnostic for the genus and seem to correlate with tolerance for waterlogging (Stützel, 1988). However, the cells of the middle cortex of the roots of *E. huanchacanum* are rigid, undifferentiated, and rounded in cross section, as shown by hand sections of the type. The roots presumably have a mechanical rather than absorptive function, facilitated by the dense growth of root hairs on lower sections of some roots, bound tightly to clumps of soil particles (mostly sand).

Although this is the first definite record of non-aerenchymatous roots in *Eriocaulon*, anatomically similar roots were found on submerged rhizomes of *E. spruceanum* Körnicke (vel aff.; *Killeen et al. 7527* [F]), a broad-leaved rosulate rheophyte collected together with *E. huanchacanum* in the Rio Pausernas.

This is consistent with the pattern seen in two other rheophytic Eriocaulaceae of rapidly flowing water, *Leiothrix fluitans* (Körnicke) Ruhland, of Minas Gerais, Brazil, and *Rondonanthus capillaceus* (Körnicke) Hensold & Giulietti, of the Guayana Highland. Both lack root aerenchyma, in contrast to the terrestrial members of their genera (Tomlinson, 1969, for *Paepalanthus capillaceus*; Giulietti, 1984). In both species, clusters of root hairs bound to sand grains can be observed. Both also have capillary leaves and elongate branched stems with roots adventitious along their length, but the stems are much stouter and more densely leafy than those of *Eriocaulon huanchacanum*.

The specialized morphology of *Eriocaulon huanchacanum* implies that it is obligately aquatic, probably in sandy-bottomed black water rivers with water all year. Its narrow habitat requirements and endemism suggest a vulnerable conservation status. The Serranía de Huanchaca, where *E. huanchacanum* is endemic, represents an isolated remnant of the Precambrian Brazilian shield, supporting a mixture of cerrado and Amazonian forest on infertile soils derived from granite and gneiss (Killeen et al., 1993).

The Rio Pausernas, from which two of the three collections were made, is also a collection site for

two other rarely collected rheophytes, *E. spruceanum* and *Paepalanthus saxicola* Körnicke.

The closest affinities of the species are not known. Its unspecialized flowers are typical for *Eriocaulon* subg. *Trimeranthus* Nakai, to which most other South American species belong. Although Asian *Eriocaulon* have been the subject of exhaustive taxonomic treatment and sectional classification (reviewed by Zhang, 1999), no such analysis is available for the New World species. Ruhland (1903) refused to attempt it due to the difficulty in discerning taxonomically useful characters, but even he employed characters of sepal fusion and symmetry in his key, which, as in *E. huanchacanum*, can vary within species and even capitula (Fig. 1G–I).

Superficially, *Eriocaulon huanchacanum* resembles the common circumtropical aquatic species *E. setaceum* L. (including *E. melanocephalum* Kunth, fide Zhang, 1999), due to the blackish capillary leaves. However, *E. setaceum* has fascicled spongy roots, leaves conspicuously fenestrate and not at all ampliate or imbricate at base, the stem swollen and nearly hollow, and numerous inflorescences borne in a terminal umbellate cluster, rather than singly. In Bolivia it favors seasonally inundated habitats.

The only other caulescent species of *Eriocaulon* with leaves less than one millimeter wide are *E. aquatile* Körnicke, endemic to Minas Gerais, Brazil (Giulietti, 1978), and *E. madagascariense* Moldenke, endemic to Madagascar. Both have pale green flat fenestrate membranous leaves with no differentiated basal sheath.

Paratypes. BOLIVIA. **Santa Cruz:** Prov. Velasco, Parque Nacional Noel Kempff M., Campamento Huanchaca I, Rio Pausernas, 26 July 1995 (fl), *T. Killeen et al. 7523* (F, MO, NY, USZ not seen); Prov. Velasco, above guard station at Las Torres, 29 June 1998 (fl), *N. Ritter et al. 4408* (F, NHA not seen).

Syngonanthus dichroanthus Hensold, sp. nov. TYPE: Brazil. Goiás: Veredão do Relâmpago, duas léguas de Carolina, 28 May 1950 (fl), *J. M. Pires & G. A. Black 2365 p.p.* (holotype, NY; isotype, P). Figure 2A–F.

Herba annua rosulata. Folia capillacea uninervia 0.7–2.0 cm longa, 0.1–0.2 mm lata, fere glabri. Inflorescentiae 1–2; pedunculi 7–13 cm longi; capitula 2.5–3.5 mm diametro; bracteae involucrales hyalinae pallidae glabrae, capitulum excedentes. Bracteae florales nullae; flores staminati: sepala cuprea glabra ca. 0.8–1.1 mm longa; flores pistillati: sepala albida glabra 1.0–1.2 mm longa; corolla glabrata; appendices styli inconspicuae.

Plants delicate rosulate annuals; roots fine, white, spongy (aerenchymatous), branched, about as wide as the leaves. *Leaves* filiform, weak and membranous, ca. 0.7–2.0 cm long, 0.1–0.2 mm wide, flat with a single sunken vein buttressed to both surfaces, very obscurely fenestrate, glabrate or with a few scattered appressed hairs. *Inflorescences* mostly 1 or 2 per plant; peduncle sheaths 16–22 × 0.3–0.6 mm, the lamina 2.5–3.5 mm long, acute; pubescent with scattered malpighian hairs or glabrous, sometimes conspicuously pale-costate especially toward the base; *peduncles* 7–13 cm long, 0.15–0.3 mm wide, 3-costate, with green intercostae and stramineous costae, the costae broadening and intercostae becoming narrow furrows toward the base; pubescent at the apex with a collar of appressed hairs, also ± pubescent with malpighian hairs on the intercostae, and sometimes with a few erect gland-tipped hairs near the apex when young, glabrate below; *capitula* 2.5–3.5 mm wide, fusiform in bud, depressed-hemispheric at maturity; involucral bracts grading from oblong-obtuse below to lanceolate-acute above, the larger 1.3–1.7 × 0.4–0.6 mm, surpassing the capitulum by 0.6–0.7 mm; hyaline-stramineous, with a faint brown tinge, glabrous; receptacle densely villous, the trichomes pure white and nearly equaling the flowers; receptacular bracts absent. *Flowers* 3-merous, short-pedicellate, the staminate and pistillate about equally mixed, of sharply contrasting colors; *staminate flowers*: *sepals* deep coppery brown, lustrous, glabrous, fused briefly at base, obovate, broadly rounded and usually erose at apex, ca. 0.8–1.1 mm long, the laterals ca. 0.4–0.5 mm wide, slightly falcate-curved and cucullate, the inner (adaxial) sepal flat and slightly smaller; *corolla* tubular, borne on a fine stipe ca. 0.5 × 0.1 mm; the corolla itself ca. 0.5 mm long, the lobes involute after anthesis; anthers white, ca. 0.15 mm long; pistillodes inconspicuous, threadlike; *pistillate flowers*: *sepals* lanceovate to ovate, navicular, acute, 1.0–1.2 × 0.35–0.5 mm, white, or slightly copper-tinged at the tips, glabrous; *petals* membranous, white, linear-spatulate, shorter than the sepals, ca. 0.9 × 0.15 mm, with a few long scattered cilia in juvenile state, glabrous at anthesis; style ca. 0.5 mm, the style branches shorter, stylar appendages small and threadlike or apparently lacking. Mature seeds not seen.

Ecology and distribution. Known from three disjunct Amazonian localities, in northern Goiás, Brazil, near the border with Maranhão (near Carolina), near Manaus, Brazil, and in Bolivia along the Río Iténez (Río Guaporé) bordering Rondônia, Brazil. It occurs in wet and seasonally inundated cam-

po below 500 m, and is possibly amphibious. (See *S. latifolius* for further discussion of habitat.)

The holotype of *Syngonanthus dichroanthus* at NY is a mixed sheet including an unidentified rosulate species of *Eriocaulon* of about the same stature. The isotype sheet at P is a mixture with the same *Eriocaulon* as well as with *Eleocharis minima* Kunth (Cyperaceae). Both sheets were distributed as *S. simplex* (Miquel) Ruhland.

This inconspicuous mud-dwelling species is known so far only from mixed collections with other diminutive species. Its relatives include several other small rosulate annuals with pale glabrous capitula, including *Syngonanthus gracilis* (Bongard) Ruhland, *S. biformis* (N. E. Brown) Gleason, *S. simplex* (Miquel) Ruhland, and *S. latifolius* (Moldenke) Hensold. *Syngonanthus dichroanthus* is distinguished from these in part by its delicate habit, membranous threadlike leaves, and involucral bracts exceeding the capitulum. From the closely sympatric and common taxon *S. gracilis* var. *aureus* Ruhland, it can usually be distinguished by the lack of glandular hairs on the peduncle sheaths. However, its most striking feature is the strong contrast between the copper-colored staminate flowers and the white pistillate flowers, an unusual characteristic shared only with *S. latifolius*.

Strong differentiation in the color of the staminate and pistillate flowers occurs to my knowledge in only a few divergent species of *Syngonanthus*. These include the dimorphic-stemmed aquatic *S. spongiosus* Hensold, with staminate flowers deep yellow-brown, and the rosette species *S. angolensis* Hess of Africa and *S. goyazensis* (Körnicke) Ruhland of Brazil, in both of which the staminate calyces are deeply pigmented only below the lobes.

The specimen from Manaus (*Lützelburg 21962 p.p.*) lacks staminate flowers, which makes positive identification difficult, but is provisionally placed here due to the glabrous flowers, involucral bracts glabrous and surpassing the capitulum (which distinguish it from *Syngonanthus biformis* and *S. simplex*), the membranous leaves, and lack of glandular hairs.

Paratype. BOLIVIA. **Santa Cruz:** Prov. Velasco, Estación Flor de Oro, margen del Río Iténez (Guaporé), frontera con Rondônia, ca. 20 km N del Serranía de Huanchaca, ca. 85 km E del Río Paragua, 15 May 1991 (fl), *M. Peña et al. 62 p.p.* (F, mixed collection with *Syngonanthus gracilis* var. *aureus* Ruhland).

Additional specimen examined. BRAZIL. **Amazonas:** Manaus, Villa Municipal, 28 Aug. 1916 (♀), *Lützelburg 21962 p.p.* (LL = fragment ex NY, mixed collection with *Utricularia* and sterile graminoid, probably Cyperaceae).

Syngonanthus latifolius (Moldenke) Hensold, comb. nov. Basionym: *Syngonanthus gracilis* var. *latifolius* Moldenke, Phytologia 21: 418. 1971. TYPE: Brazil. Mato Grosso: Serra do Roncador, gallery margin, ca. 86 km N of Xavantina, 550 m, 31 May 1966 (fl, fr), *H. S. Irwin, J. W. Grear Jr., R. Souza, R. Reis dos Santos 16349* (holotype, NY). Figure 2G–J.

Plants rosulate annuals; roots white, spongy, branched, the larger 0.5–0.7 mm diam. *Leaves* recurved, ± prostrate, ca 1.0–1.2 cm long, 1.0–1.5 mm wide, ligulate, subacute, the tip minutely recurved and keeled; 3- to 5-veined, the midvein visible adaxially as a white line, at least in the basal half; pubescent abaxially with short appressed malpighian hairs, and adaxially with long filamentous arachnoid hairs, both surfaces glabrate. *Inflorescences* numerous, ca. 25 to 50, of mixed ages, sometimes with new inflorescences initiating outside the older ones; peduncle sheaths 10–17 × 0.6–0.8 mm diam., the lamina ca. 2 mm long, acute, callous-tipped, slightly recurved; arachnoid pubescent as the leaves, also with scattered upright gland-tipped hairs; white-costate only near the base; *peduncles* 6–15 cm long, (0.25–)0.3–0.4 mm wide, 3-costate; the intercostae green and arachnoid pubescent, broad near the apex, narrowing to thin furrows below; the costae stramineous, glabrous, shiny, with a few gland-tipped hairs when young; *capitula* 4–5.5 mm diam., ovoid in bud, depressed-hemispheric to globose at maturity; involucral bracts hyaline, glabrous, lustrous, the outer obovate, rounded-apiculate at apex, pale, shredding with age, the inner oblanceolate-obtuse to linear-acute and gold with a brown tint; shorter than the pistillate flowers; receptacle densely white-villous, trichomes about equaling the staminate flowers; receptacular bracts absent. *Flowers* 3-merous, the staminate and pistillate about evenly mixed and strongly dimorphic, the staminate flowers pigmented and much shorter than the pistillate, the pistillate surpassing the involucral bracts by 0.6–0.7 mm, abscising after seed set; *staminate flowers*: pedicels ca. 0.15–0.25 mm; *calyx* coppery brown, zygomorphic, the segments ca. 1.0 × 1.0 mm, broadly obovate-spatulate, rounded, slightly cucullate, fused ca. ½–⅔ of their length, sparingly pubescent to glabrate on the abaxial face; *corolla* borne on stipe ca. 0.5 × 0.1 mm; the corolla itself ca. 0.35 mm long, membranous, the lobes involute; filaments ca. 0.35 mm, adnate to corolla; anthers white, 0.2 mm long; pistillodes ca. 0.25 mm long, infundibular, the rim papillate; *pistillate flowers*: pedicels ca. 0.5 mm long; *sepals* oblong-elliptic, acute to broadly acuminate, navicular and slightly sclerified along midvein at base,

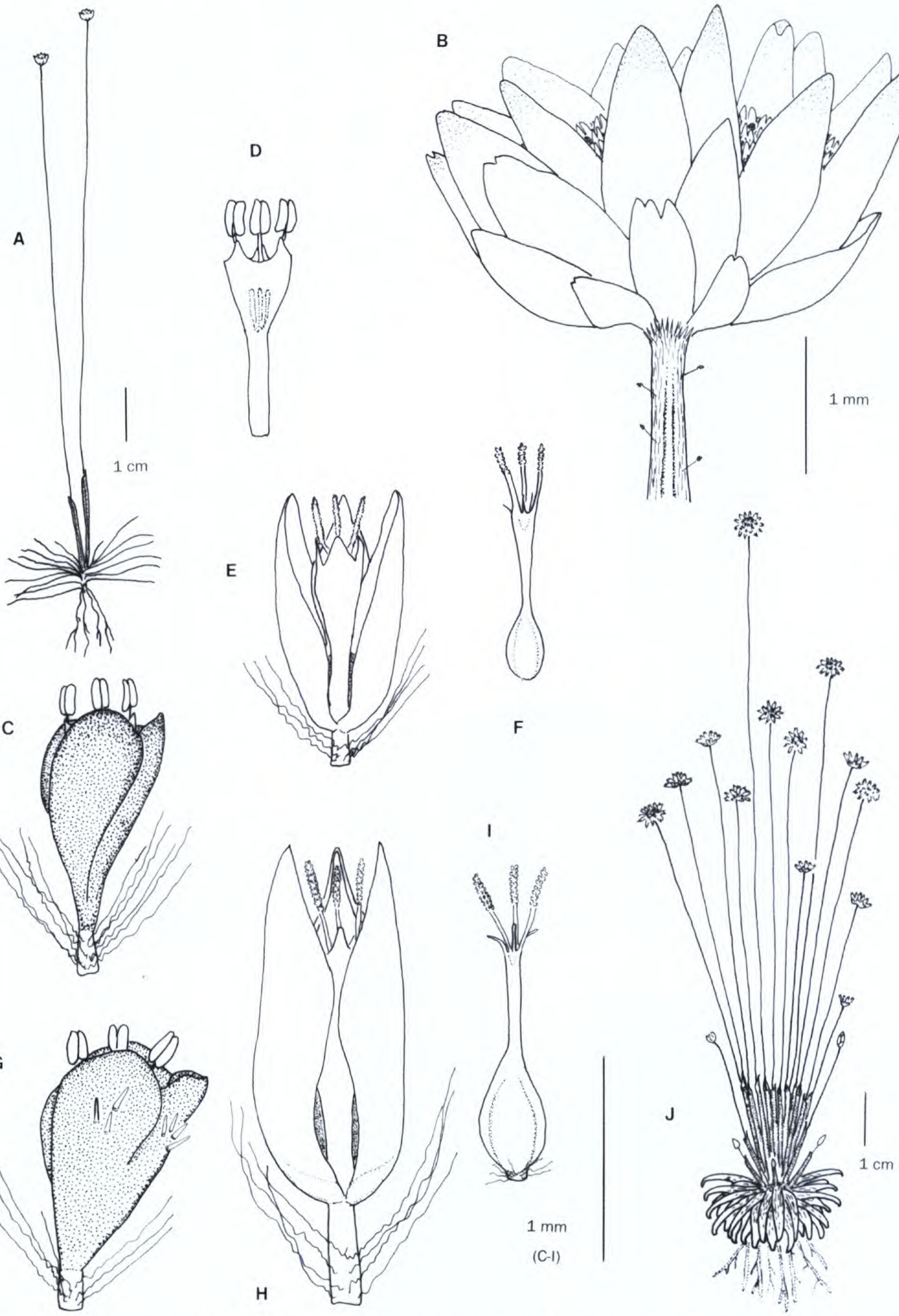

Figure 2. A–F. *Syngonanthus dichroanthus* Hensold. —A. Habit. —B. Capitulum. —C. Staminate flower. —D. Corolla of staminate flower. —E. Pistillate flower. —F. Gynoecium. G–J. *Syngonanthus latifolius* (Mold.) Hensold. —G. Staminate flower. —H. Pistillate flower. —I. Gynoecium. —J. Habit. Vouchers: A–F *Pires & Black 2365*; G–J *Irwin et al. 16349*.

1.7–2.0 × 1.0 mm, white-hyaline, tinged brown at apex, glabrous; *corolla* short-stipitate, the petals fused at middle margins, free at base and apex, linear-oblanceolate, acute to acuminate, involute after anthesis, ca. 1.1–1.3 × 0.25 mm, membranous, glabrous at maturity; style ca. 0.6 mm long, style branches ca. 0.4 mm long, appendages small and filamentous. Seeds red-brown, ca. 0.4 × 0.2 mm, with raised white longitudinal ribs after wetting, the epidermis waxy (under SEM).

Ecology and distribution. Known from a single collection in marshy campo at 550 m, at the margin of gallery forest in cerrado of northeastern Mato Grosso, Brazil, ca. 52°W, 14°S.

Syngonanthus latifolius was originally described as a variety of *S. gracilis* (Bongard) Ruhland, distinguished from other varieties by the leaves wider and more closely appressed to the ground. The marked size and color dimorphism of the flowers were not noted in the original description, however, and together with the leaf characters, support recognition of the taxon as a distinct species.

The closest affinity of *Syngonanthus latifolius* is probably with *S. dichroanthus* Hensold, which has a nearly identical floral structure and color dimorphism, but flowers subequal in size, and membranous filiform leaves. In *S. latifolius*, the sepals and pedicels of the pistillate flowers are nearly twice as long as those of the staminate flowers, such that the small rounded golden-brown staminate flowers are dwarfed by the white acute pistillate flowers with which they are intermixed. Similar differentiation in flower size and a similar aspect to the capitulum are matched only in the species *S. biformis* (N. E. Brown) Gleason, but the latter is distinguished by its uniformly white flowers, pubescent involucres, densely pubescent petals in the pistillate flowers, and prominent style appendages.

Affinity is also suggested with *Syngonanthus gracilis* var. *aureus*, with which *S. latifolius* shares the annual habit, nearly glabrous sepals and petals, reduced filiform style appendages, and the waxy coating observed on the seeds under SEM (Hensold, unpublished data).

Both *Syngonanthus latifolius* and *S. dichroanthus* have been collected together with *S. gracilis* var. *aureus* in wetlands (veredas) associated with cerrado. Eiten (1975) described in detail the abruptly delineated "seasonally marshy grassy campos" or "hillside campos," which separate gallery forests from upland cerrado in the Brazilian Serra do Roncador and elsewhere. Created by rainy season drainage, these campos have gleyed soils, especially in their lower, wetter portions, where Eriocaulaceae are reported as a typical element. *Syngonanthus dichroanthus* may occur on wetter sites than *S. latifolius*, since both the Río Iténez site and the veredão in Maranhão are inundated for longer periods than the valleys of the Serra do Roncador (Eiten, 1975), but more collections are needed to confirm this.

Additional specimen examined. BRAZIL. **Mato Grosso:** Serra do Roncador, gallery margin, ca. 86 km N of Xavantina, 550 m, 31 May 1966, *H. S. Irwin et al. 16346 p.p.* (GH) [mixed sheet with *S. gracilis* var. *aureus* Ruhland, probably from the same gathering as *Irwin et al. 16349*, the type].

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Subtribes of Principally North American Genera of Cichorieae (Compositae)

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ABSTRACT. A new subtribal classification for principally North American genera of Cichorieae allows for a practical taxonomy that reflects recent phylogenetic hypotheses. We propose the new subtribes Lygodesmiinae (for *Chaetadelpha*, *Lygodesmia* sensu Tomb, and *Shinnersoseris*), Pinaropappinae (for *Marshalljohnstonia* and *Pinaropappus*), Pyrrhopappinae (for *Picrosia* and *Pyrrhopappus*), and three monogeneric subtribes (Glyptopleurinae (*Glyptopleura*), Krigiinae (*Krigia*), and Phalacroseridinae (*Phalacroseris*)) for taxa previously treated in Malacothricinae, Microseridinae, and Stephanomeriinae. We recognize novel circumscriptions for Malacothricinae (*Anisocoma*, *Atrichoseris*, *Calycoseris*, and *Malacothrix*), Microseridinae (*Agoseris*, *Microseris*, *Nothocalais*, *Stebbinsoseris*, and *Uropappus*), and Stephanomeriinae (*Munzothamnus*, *Pleiacanthus*, *Prenanthella*, *Rafinesquia*, and *Stephanomeria*). The revised classification provides a more precise taxonomic representation of relationships among genera, insofar as robust resolution of monophyletic groups currently allows.

Key words: Cichorieae, Lactuceae, Malacothricinae, Microseridinae, Stephanomeriinae, subtribes, taxonomy.

Phylogenetic analyses of 18S–26S nuclear rDNA external and internal transcribed spacer sequences (Lee et al., 2002, 2003) and chloroplast DNA restriction sites (Jansen et al., 1991; Whitton et al., 1995) yielded evidence for new hypotheses of relationship among all genera of Cichorieae (Lactuceae) that have natural centers of diversity in North America (plus *Picrosia*, endemic to South America). On the basis of molecular findings, Lee et al. (2003) concluded that taxa previously treated in subtribes Malacothricinae, Microseridinae, and Stephanomeriinae (e.g., Stebbins, 1953; Bremer, 1993, 1994) or in Jeffrey's (1966) "Microseris subgroup" and "Stephanomeria subgroup" represent a single major radiation, with a large western North American component. As previously treated, each of those subtribes and subgroups is evidently paraphyletic or polyphyletic. To better reflect phylogenetic relationships, we propose revised circumscriptions for Malacothricinae, Microseridinae, and Stephanomeriinae and recognize six new subtribes.

Malacothricinae K. Bremer, Novon 3: 329. 1993. TYPE: *Malacothrix* DC.

Annual or perennial herbs. Leaf blades linear, elliptic, lanceolate, oblanceolate, obovate, or spatulate; margins entire, denticulate, lobed, or pinnatifid. Capitulescences corymbiform or capitula borne singly (peduncles scapiform). Receptacles not paleate, bristly or not bristly. Involucres cylindrical to obconic or campanulate. Phyllaries in 3 to 6 series, unequal (1 or 2 subequal series in *Atrichoseris*). Florets 15 to 250 per capitulum. Corollas yellow or white (often with abaxial reddish stripes). Cypselae columnar to fusiform, 5- to 15-ribbed or -veined (5 usually prominent), beaked (*Calycoseris*) or not beaked. Pappi 0 (*Atrichoseris*) or of 15 to 40 subequal, barbellate or, rarely, plumose (*Anisocoma*), persistent or often (all or mostly) caducous or fragile bristles and sometimes an outer crown of minute teeth. Pollen echinate (Tomb et al., 1974). Chromosome number $2n = 14, 18, 20$.

Included genera: *Anisocoma* Torrey & A. Gray, *Atrichoseris* A. Gray, *Calycoseris* A. Gray, *Malacothrix* DC.

Microseridinae Stebbins ex Solbrig, Taxon 12: 234. 1963. TYPE: *Microseris* D. Don.

Annual, biennial, or perennial herbs. Leaf blades linear, oblong, lanceolate, oblanceolate, or spatulate; margins entire, denticulate, sinuate, lobed, or pinnatifid. Capitulescences branched or, often, capitula borne singly (peduncles scapiform). Receptacles not paleate, not bristly. Involucres subcylindrical to obconic or campanulate. Phyllaries in

2+ series, subequal or unequal, the outer sometimes forming calyculi. Florets 5 to 300+. Corollas yellow, orange, or white (sometimes with abaxial reddish stripes). Cypselae columnar or fusiform, ± 10-ribbed, beaked (*Agoseris*) or not. Pappi of (0)2 to 90 equal or unequal, smooth to barbellate (rarely plumose) bristles or bristle-tipped scales, persistent or caducous. Pollen echinolophate (Feuer & Tomb, 1977). Chromosome number $2n = 18$, 27 (triploid), or 36.

Included genera: *Agoseris* Rafinesque, *Microseris* D. Don, *Nothocalais* (A. Gray) Greene, *Stebbinsoseris* K. L. Chambers, *Uropappus* Nuttall.

Stephanomeriinae Stebbins ex Solbrig, Taxon 12: 235. 1963. TYPE: *Stephanomeria* Nuttall.

Annual or perennial herbs, or shrubs. Leaf blades linear, oblong, lanceolate, oblanceolate, obovate, or scale-like; margins entire, sinuate-dentate, lobed, or pinnatifid. Capitulescences corymbiform to thyrsoid-paniculiform. Receptacles not paleate, not bristly. Involucres narrowly cylindrical or obconic. Phyllaries usually in 2 series, unequal (outer forming calyculi), sometimes graduated (*Stephanomeria cichoriacea*). Florets 3 to 15 (to 30 in *Rafinesquia*) per capitulum. Corollas pink, purple, or white. Cypselae clavate, columnar, or fusiform, smooth, sometimes grooved or ≤ 5-ribbed, beaked (*Rafinesquia*) or not. Pappi of 5 to 20+ equal or unequal (*Prenanthella*), plumose (*Rafinesquia*, *Stephanomeria*), or barbellate, persistent, or deciduous (*Munzothamnus*) bristles. Pollen echinate (Tomb et al., 1974). Chromosome number $2n = 14$ (*Prenanthella*), 16, 24 (triploid), or 32.

Included genera: *Munzothamnus* P. H. Raven, *Pleiacanthus* Rydberg, *Prenanthella* Rydberg, *Rafinesquia* Nuttall, *Stephanomeria* Nuttall.

Glyptopleurinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Glyptopleura* D. C. Eaton.

Herbae annuae. Laminae foliorum spatulatae vel oblongae, profunde lobatae vel pinnatifidae; margines albi, scariosi, dentati vel setoso-ciliati. Capitula portata singulatim vel capitulescentiae parce ramosae. Receptacula epaleata, non setosa. Involucra cylindracea vel urceolata, ad bases bracteis spatulatis marginibus albis, scariosis, dentatis. Phyllaria 2-seriata, ± aequalia. Flosculi 7–16. Corollae cremeae vel luteolae (in sicco subroseae). Cypselae clavatae, tuberculatae, valde costatae, rostratae. Pappi constati ex setis 100+, aequalibus, barbellatis, extimis deciduis. Pollina echinata. $2n = 18$.

Annual herbs. Leaf blades spatulate to oblong, deeply lobed to pinnatifid; margins white, scarious, dentate or setose-ciliate. Capitula borne singly or capitulescences sparingly branched. Receptacles not paleate, not bristly. Involucres cylindrical to urceolate, at base with spatulate bracts with margins white, scarious, toothed. Phyllaries 2-seriate, ± equal. Florets 7 to 16 per capitulum. Corollas cream-colored to light yellow (when dry, pink). Cypselae clavate, tuberculate, strongly ribbed, beaked. Pappi of 100+ equal, barbellate bristles, the outermost deciduous. Pollen echinate (Tomb et al., 1974). Chromosome number $2n = 18$.

Included genus: *Glyptopleura* D. C. Eaton.

Krigiinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Krigia* Schreber.

Herbae annuae vel perennes. Laminae foliorum lineares, oblongae, lanceolatae, vel oblanceolatae; margines integri, lobati, vel pinnatifidi. Capitula portata singulatim vel capitulescentiae cymosae vel interdum superne subumbellatae. Receptacula epaleata. Involucra turbinata, campanulata, vel urceolata. Phyllaria 1–2+-seriata, aequalia. Flosculi 4–30. Corollae flavae vel aurantiacae. Cypselae columnares vel ovoideae, 10–20-nervatae vel -costatae, non rostratae. Pappi nulli vel ex squamis 5+ constati (interdum fascientibus coronis minutis), plerumque cingentibus setis 5+, inaequalibus, spiculatis. Pollina echinolophata. $2n = 8$, 10, 12, 18, 20, 30, vel 60.

Plants annual or perennial herbs. Leaf blades linear, oblong, lanceolate, or oblanceolate; margins entire, lobed, or pinnatifid. Capitula borne singly or capitulescences cymiform or subumbelliform. Receptacles not paleate. Involucres turbinate, campanulate, or urceolate. Phyllaries 1- or 2+-seriate, equal. Florets 4 to 30 per capitulum. Corollas yellow or orange. Cypselae columnar or ovoid, 10- to 20-nerved or -ribbed, not beaked. Pappi none or of 5+ scales (sometimes forming minute crowns), usually surrounding 5+, unequal, spiculate bristles. Pollen echinolophate (Feuer & Tomb, 1977). Chromosome number $2n = 8$, 10, 12, 18, 20, 30, or 60.

Included genus: *Krigia* Schreber.

Lygodesmiinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Lygodesmia* D. Don.

Herbae annuae (*Shinnersoseride*) vel perennes. Laminae foliorum lineares vel lanceo-lineares (vel squamiformes distaliter); margines plerumque integri, interdum lobati. Capitula raro portata singulatim, capitulescentiae plerumque ramosissimae. Receptacula epaleata. Involucra cylindracea vel subcylindracea. Phyllaria 2-seriata, inaequalia (extimis fascientibus calyculis). Flosculi 5–12. Corollae subrosaceae, purpureae, vel albae. Cypselae columnares vel fusiformes, laeves, striatae, rugosae, vel costatae, non rostratae. Pappi ex setis 24–250, aequalis, barbellatis (et squamis 5, subulatis in *Chaetadelpha*), constati omnibus persistentibus. Pollina echinata vel echinolophata (*Lygodesmia*). $2n = 12$ (*Shinnersoseride*) vel 18, vel 27 (triploideis).

Annual (*Shinnersoseris*) or perennial herbs. Leaf blades linear or lance-linear (or scale-like distally); margins usually entire, sometimes lobed. Capitula rarely borne singly, capitulescences usually much-branched. Receptacles not paleate. Involucres cylindrical or subcylindrical. Phyllaries 2-seriate, unequal (the outer forming calyculi). Florets 5 to 12 per capitulum. Corollas pink, purple, or white. Cypselae columnar or fusiform, smooth, striate, rugose, or ribbed, not beaked. Pappi of 24 to 250 equal, barbellate bristles (and 5, subulate scales in *Chaetadelpha*), all persistent. Pollen echinate or echinolophate (*Lygodesmia*) (Tomb et al., 1974). Chromosome number $2n = 12$ (*Shinnersoseris*) or 18, or 27 (triploids).

Included genera: *Chaetadelpha* A. Gray, *Lygodesmia* D. Don (sensu Tomb), *Shinnersoseris* Tomb.

Phalacroseridinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Phalacroseris* A. Gray.

Herbae perennes. Laminae foliorum lineares, lanceolineares, vel oblanceolatae; margines integri. Capitula portata singulatim (pedunculis scapiformibus); receptacula epaleata; involucra campanulata; phyllaria 2+-seriata, aequalia. Flosculi 13+, corollae flavae. Cypselae fusiformes, laeves, non rostratae; pappi nulli. Pollina echinolophata. $2n = 18$.

Perennial herbs. Leaf blades linear, lance-linear, or oblanceolate; margins entire. Capitula borne singly (peduncles scapiform). Receptacles not paleate. Involucres campanulate. Phyllaries 2+-seriate, equal. Florets 13+ per capitulum. Corollas yellow. Cypselae fusiform, smooth, not beaked. Pappi none. Pollen echinolophate (Feuer & Tomb, 1977). Chromosome number $2n = 18$.

Included genus: *Phalacroseris* A. Gray.

Pinaropappinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Pinaropappus* Lessing.

Herbae perennes vel frutices rosulatae (*Marshalljohnstonia*). Laminae foliorum lineares (vel squamiformes distaliter), ellipticae, vel rhombeae; margines integri, dentati, vel lobati. Capitula portata singulatim. Receptacula paleata (*Pinaropappo*) vel epaleata. Involucra obconica vel campanulata. Phyllaria 3+-seriata, inaequalia. Flosculi 10–18. Corollae subrosaceae, purpureae, vel albae. Cypselae sulcis 5, angustis, aequaliter dispositis, columnares vel fusiformes, non rostratae (distaliter attenuatae in *Pinaropappo* p.p.). Pappi ex setis 40–60, aequalis, barbellatis, persistentibus constati. Pollina echinata. $2n = 18$ vel 36.

Perennial herbs or rosette shrubs (*Marshalljohnstonia*). Leaf blades linear (or scale-like distally), elliptic, or rhombic; margins entire, dentate, or lobed. Capitula borne singly. Receptacles paleate (*Pinaropappus*) or not paleate. Involucres obconic or campanulate. Phyllaries 3+-seriate, unequal. Florets 10 to 18 per capitulum. Corollas pink, purple, or white. Cypselae columnar or fusiform, with 5 narrow, equally spaced furrows, not beaked (distally attenuate in *Pinaropappus* pro parte). Pappi of 40 to 60 equal, barbellate bristles, persistent. Pollen echinate (Tomb et al., 1974). Chromosome number $2n = 18$ or 36.

Included genera: *Marshalljohnstonia* Henrickson, *Pinaropappus* Lessing.

Pyrrhopappinae Joongku Lee & B. G. Baldwin, subtribus nov. TYPE: *Pyrrhopappus* DC.

Herbae annuae vel perennes. Laminae foliorum ellipticae, lanceolatae, vel oblanceolatae; margines integri vel pinnatifidi. Capitula portata singulatim vel capitulescentiae laxe corymbiformes. Involucra cylindracea vel anguste campanulata. Phyllaria 2-seriata, inaequalia (extimis fascientibus calyculis). Flosculi 30–150+. Corollae flavae, purpureae, vel albae. Cypselae fusiformes, 5–12-costatae, rostris fragilibus. Pappi ex setis 119–155, aequalis, barbellatis (cum pilis minutis, reflexis subtentis in *Pyrrhopappo*) constati, persistentibus. Pollina echinata (*Picrosia*) vel echinolophata (*Pyrrhopappo*). $2n = 12$, 14, vel 24.

Annual or perennial herbs. Leaf blades elliptic, lanceolate, or oblanceolate; margins entire or pinnatifid. Capitula borne singly or capitulescences loosely corymbiform. Receptacles not paleate. Involucres cylindrical to narrowly campanulate. Phyllaries 2-seriate, unequal (the outer forming calyculi). Florets 30 to 150+ per capitulum. Corollas yellow, purple, or white. Cypselae fusiform, 5- to 12-ribbed, beaks fragile. Pappi of 119 to 155 equal, barbellate bristles (subtended by minute, reflexed hairs in *Pyrrhopappus*), persistent. Pollen echinate (*Picrosia*) or echinolophate (*Pyrrhopappus*) (Feuer & Tomb, 1977). Chromosome number $2n = 12$, 14, or 24.

Included genera: *Picrosia* D. Don, *Pyrrhopappus* DC.

Key to Principally North American Subtribes of Cichorieae

1a. Capitulescences monocephalic (capitula borne singly); cypselae not ribbed or furrowed; pappi absent . . . . . Phalacroseridinae

1b. Capitulescences corymbiform to thyrsoid-paniculiform or subumbelliform, or if monocephalic, then cypselae ribbed or furrowed and pappi present (rarely absent in *Microseris douglasii*).

2a. Cypselae beaked.

3a. Some or all pappus bristles caducous or fragile.

4a. Capitulescences stipitate-glandular (gland heads ± disk-shaped); pappus bristles falling together . . . . . Malacothricinae p.p. (*Calycoseris*)
4b. Capitulescences not stipitate-glandular; outer pappus bristles caducous or fragile, the inner persistent . . . . . Glyptopleurinae
3b. Pappus bristles persistent.
5a. Pappus bristles plumose . . . . . Stephanomeriinae p.p. (*Rafinesquia*)
5b. Pappus bristles barbellate or smooth.
6a. Capitulescences monocephalic; corollas yellow or orange; beaks shorter than to much longer than bodies of cypselae; apices of beaks glabrous . . Microseridinae p.p. (*Agoseris*)
6b. Capitulescences usually loosely corymbiform, sometimes monocephalic; corollas yellow, purple, or white; beaks much longer than bodies of cypselae; apices of beaks glabrous or villous (if capitulescences monocephalic and corollas yellow, then apices of beaks villous) . . . . . Pyrrhopappinae
2b. Cypselae not beaked (apically attenuate in *Pinaropappus* and *Uropappus*).
7a. Corollas usually yellow or orange (if white, then pappi of scales, scales and bristles, or bristle-tipped scales); pollen echinolophate.
8a. Phyllaries in 1 or 2 series, subequal, the outer not forming calyculi; pappi of scales or scales and bristles . . . . . Krigiinae
8b. Phyllaries in 2+ series, subequal or unequal, the outer sometimes forming calyculi; pappi of bristle-tipped scales or bristles . . . . . Microseridinae
7b. Corollas often pink or purple (if yellow or white, then pappi absent (*Atrichoseris*) or of only bristles); pollen usually echinate (echinolophate in *Lygodesmia*).
9a. Receptacles not paleate, often bristly; florets 15 to 250 per capitulum; corollas usually yellow, sometimes white; pappus bristles often all or mostly caducous or readily falling . . . . . Malacothricinae
9b. Receptacles usually not paleate, rarely paleate (*Pinaropappus*), not bristly; florets 3 to 18 per capitulum; corollas usually pink or purple, sometimes white; pappus bristles usually persistent.
10a. Capitulescences monocephalic; phyllaries in 3+ series, unequal . . . . . Pinaropappinae
10b. Capitulescences usually corymbiform to thyrsoid-paniculiform, rarely monocephalic; phyllaries usually in 2 unequal series, the outer forming a calyculus.
11a. Plants non-thorny herbaceous perennials or opposite-leaved annuals (*Shinnersoseris*); pappus bristles barbellate; pollen usually echinolophate, rarely echinate (*Chaetadelpha*, *Shinnersoseris*) . . . . . Lygodesmiinae
11b. Plants thorny and non-thorny herbaceous perennials, alternate-leaved annuals, or shrubs; pappus bristles usually plumose (if barbellate and plants herbaceous perennials, then stems thorny (*Pleiacanthus*)); pollen echinate Stephanomeriinae

An expanded phylogenetic study of Malcothricinae is under way to resolve the memberships of lineages within the non-monophyletic *Malacothrix*, prior to generic redelimitation. We are also studying relationships of *Thamnoseris* (endemic to Islas Desventuradas, Chile), which was included by Stebbins (1953) in Stephanomeriinae. Data from additional gene regions are needed to gain refined understanding of the relationships among the subtribes of New World Cichorieae treated here.

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A New Combination in *Matelea* (Apocynaceae–Asclepiadoideae)

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ABSTRACT. *Chthamalia cuyabensis* is transferred to *Matelea cuyabensis* and is lectotypified.

Key words: Apocynaceae, Asclepiadoideae, *Chthamalia*, *Matelea*.

In the course of compiling the Asclepiadoideae for the *Prodromus Florae Matogrossensis* (ed. B. Dubs, Switzerland), a species attributed to the genus *Chthamalia* Decaisne (Apocynaceae–Asclepiadoideae; tribe Asclepiadeae, subtribe Gonolobinae) turned up. The genus *Chthamalia*, comprising eight species, was sunk by Woodson (1941) under *Matelea* Aublet, and Woodson (1941) combined the four North and Central American species, including the type species, *C. nummularia* Decaisne, under *Matelea*. The four Brazilian species were not treated by Woodson (1941).

The genus *Matelea*, with some 280 species, is one of the least known genera of Asclepiadoideae, and opinions diverge widely concerning the question whether *Matelea* is one large, variable genus, or whether several monophyletic genera are hidden within *Matelea*, or whether *Matelea* even has to be expanded to comprise the ca. 100 *Gonolobus* Michaux species as well. No molecular phylogeny is yet available, and only some, mostly geographically restricted, revisions have been carried out in the last decades (e.g., Stevens, 1985, 1988, 2001). In Brazil, from where ca. 70 species of *Matelea* s.l. are recorded, none of the four *Chthamalia* species has been mentioned in the literature lately. Nevertheless, Rapini (2001) cited *Chthamalia* as a synonym under *Matelea*, and there is no apparent morphological reason to reach a different conclusion. As the name *Chthamalia* has ceased to exist with the transfer of the type species to *Matelea* by Woodson (1941), it is necessary to combine *Chthamalia cuyabensis*, the only species recorded from Mato Grosso, to *Matelea cuyabensis* in order to have a valid name available for the *Prodromus Florae Matogrossensis*, which is about to be published. As there is, to our knowledge, no ongoing research on *Matelea* s.l. in Brazil, and as a new name would need to be found (*Chthamalia* not being available anymore) if new results were to require the split of the species from *Matelea*, we consider it best practice to transfer the species in question to *Matelea*, while leaving the remaining three Brazilian species, for which no immediate need for a name is known, untouched for future research. *Chthamalia cuyabensis* was first described by Malme (1927), who considered it closely related to *C. majori* E. Fournier from São Paulo, from which it is said to differ by smaller flowers and the form of the leaves. Both characters may prove to be unreliable if more material comes to light, and it cannot be excluded that *C. cuyabensis* might constitute a subspecies, a variety, or even only a synonym of *C. majori*. However, currently available data do not permit such conclusions.

Matelea cuyabensis (Malme) Liede & Meve, comb. nov. Basionym: *Chthamalia cuyabensis* Malme, Ark. Bot. 21A(12): 22, t. 1, f. 2. 1927. TYPE: Brazil. Mato Grosso: Cuyabá, 12 Nov. 1902, *G. O. A. N. Malme II 2562* (lectotype, designated here, G not seen).

The protologue is accompanied by an illustration of the habit, flower, and pollinarium.

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Three New Species of Celastraceae (Hippocrateoideae) from Southeastern Brazil, and a New Combination in *Peritassa*

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ABSTRACT. The new *Peritassa sadleri* and *Peritassa longifolia* are distinguished by their habit, leaf characteristics, color of flowers, shape of petals, number of ovules, size of inflorescences, and size of fruits. The new species *Salacia nemorosa* is distinguished from other southeastern Brazilian species by inflorescences, disc details, and size and shape of flowers and fruits. The new combination in *Peritassa* is also proposed: *Peritassa glabra* (A. C. Smith) Lombardi.

RESUMO. As novas espécies *Peritassa sadleri* e *Peritassa longifolia* são distintas pelos hábitos, morfologia das folhas, cor das flores, forma das pétalas, número de óvulos e tamanho das inflorescências e dos frutos. *Salacia nemorosa* difere das outras congêneres do sudeste do Brasil pelas inflorescências, detalhes do disco e tamanho e forma das flores e dos frutos. Também uma nova combinação em *Peritassa* é proposta: *Peritassa glabra* (A. C. Smith) Lombardi.

Key words: Brazil, Celastraceae, Hippocrateoideae, *Peritassa*, *Salacia*.

The former family Hippocrateaceae is today included in the Celastraceae as a subfamily, which includes 5 tribes, 24 genera, and ca. 357 described species (Hallé, 1990; Mennega, 1997) distributed worldwide in tropical and subtropical areas.

The delimitations of the Neotropical genera are notoriously controversial, ranging from 2, *Salacia* and *Hippocratea* (Peyritsch, 1878), to 17 by Miers's (1872) account. In this work I followed Smith (1940), who recognized three genera segregated from *Salacia* L., *Cheiloclinium* Miers, *Peritassa* Miers, and *Tontelea* Aublet, included in the tribe Salacieae with the African *Salacighia* Loesener and *Thyrsosalacia* Loesener (Mennega, 1997).

The genus *Peritassa* is restricted to the Neotropics with 14 species (Lombardi & Temponi, 1999; Mennega, 1997). *Peritassa* was described by Miers (1872) and segregated from *Salacia* by its anthers with longitudinal dehiscence with a prominent connective and a tubular nectariferous disc.

Salacia is a genus of ca. 200 species (Mennega, 1997), distributed worldwide in the tropics and subtropics. Smith (1940) recognized 29 species from the Neotropics. The last comprehensive taxonomic study of the genus, although unpublished, is Hedin (1999), who recognized 38 species in the Neotropics, including 3 new taxa from Costa Rica, Ecuador, and Peru.

The probable paraphyly of *Salacia* s. str. has been pointed out in recent molecular studies (Simmons et al., 2001a, b), but before a more extensive analysis of worldwide representative species on both morphological and molecular aspects, it is premature to propose any generic realignments.

While working on a taxonomic study of Brazilian species of Hippocrateoideae, as part of a study of the Neotropical species, I discovered three new species from the Espírito Santo Atlantic ridge (Serra do Mar): two in *Peritassa* and one in *Salacia*. These newly described species occur in an area with few forest fragments, remnants from a vegetation continuous in the past but almost totally depleted now in Espírito Santo.

Peritassa sadleri Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Itarana, Alto Jatiboca, Faz. Frederico Sadler, 20°00′48.6″S, 40°54′39.9″W, 786 m, 26 Feb. 2003, *J. A. Lombardi 5205, A. Salino, R. C. Mota & L. G. Temponi* (holotype, BHCB; isotypes, MBM, MBML, MO, NY, SPF). Figure 1.

Peritassae mexiae disco brevi-tubulari et antherarum dehiscentia transversali-obliqua affinis, sed habitu, florum colore, petalis orbicularibus, ovulorum numero et fructuum forma et dimensione differt. Etiam *Peritassae longifoliae* hic descriptae affinis, sed habitu, pedicelli dimensione et fructuum forma et dimensione differt.

Small tree, 4–5 m, glabrous, branches terete, lenticellate, sulcate, smooth, with seasonal growth marked by scale-like cataphylls. Leaves opposite; stipules 0.4–0.8 mm long, caducous, triangular,

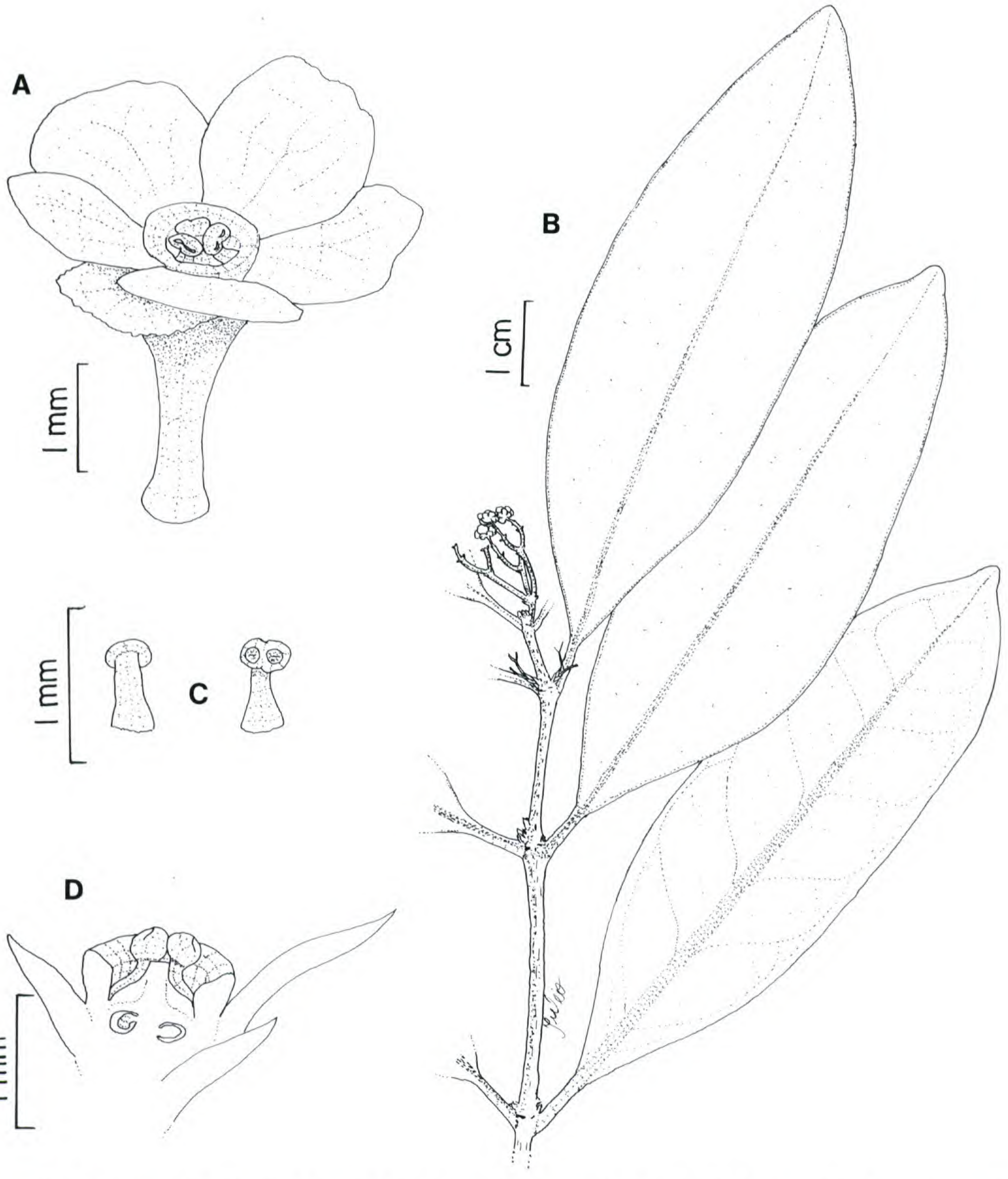

Figure 1. *Peritassa sadleri* Lombardi. —A. Lateral view of flower. —B. Branch with leaves and inflorescences. —C. Lateral and adaxial views of stamens. —D. Lateral view of middle section of open flower showing disc, two stamens, and pistil. Drawn from the holotype, *Lombardi et al. 5205* (BHCB).

apiculate, minutely erose; petioles 0.4(–0.8) cm, canaliculate; blades 5.9–7.2(14.9) × 1.4–2.8(4.1) cm, elliptic, chartaceous, drying brown, the base cuneate, the apex acute or acuminate, tip cleft or apiculate, the margin entire and thickened, cream-colored when dry, venation brochidodromous with veins slightly prominulous on both sides. Inflorescence thyrsoid-paniculate, 0.9–1.4 × 1–1.5 cm, with 28 to 49 flowers, axillary, sometimes at leafless nodes; bracts 0.7–1.2 mm long, triangular, the margin minutely erose, scarious; peduncle 0.1–0.3(–0.7) cm long, terete, in old leafy nodes covered by triangular scales, on new shoots sometimes at leafless nodes and naked, then minutely lenticellate-punctulate; inflorescence branches opposite or subopposite, terete; pedicels (1.2–)1.7 mm long, terete, minutely punctulate, articulate at base; bracteoles 2, opposite at base of pedicel, triangular, 0.4 mm

long. Flowers green, 3.7–4 mm wide at anthesis; sepals 5, 1.2–1.3 × 1–1.1 mm, elliptic, unequal, ± carnose, the margin minutely erose; petals 5, 1.5–1.8 × 1.6–1.7 mm, subcircular, ± carnose, spreading at anthesis, the margin minutely erose; disc annular, short-tubular, ca. 0.4 mm high, 0.2 mm thick, carnose, free from reproductive parts, the margin entire; stamens 3, ca. 0.8 mm long, in open flower exserted and reflexed, the filaments flattened, the connective adaxially thickened, not surpassing the thecae, the anthers ca. 0.17 × 0.42 mm, oblong, slightly emarginate at base, basifixed, dehiscence extrorse by almost transverse apical slits; pistil 0.6 × 0.63 mm, conic, ovary slightly 3-lobed, 3-locular, with 2 subapical ovules in each locule, style ca. 0.16 mm long after anthesis, central, terete, stigmas obscure. Mature drupes 4–6.8 × 2.6 × 2.1 cm, ellipsoid, the epicarp crustaceous, smooth, drying light brown-pruinose, minutely cream-colored punctuate; seeds not seen.

Phenology. Collected with flowers and very young fruits in February; collected with mature fruits in October.

Distribution and habitat. *Peritassa sadleri* occurs at altitudes of 700–800 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil. This area has many small properties with old coffee plantations and pastures; each of these maintains small portions of forest in varied degrees of preservation in order to fulfill federal government legislation. However protected by environmental laws, the conservation of this species is not sure while it is known only from outside of official conservation sites.

Etymology. The specific epithet of this species is an homage to the Brazilian-Pomeranian Sadler family who has preserved an apparently almost intact tract of forest at the intersection of many family members' properties.

This new species resembles *Peritassa mexiae* A. C. Smith by the disc, stamens, and pistil, but can be distinguished by the habit (small tree vs. liana), color of dried leaves (brown vs. cinereous), smaller inflorescences (0.9–1.4 × 1–1.5 cm vs. (0.8–)2.3–5.0 × (0.8–)2.8–7.1 cm), color of flowers (green vs. yellow), shape of petals (± circular vs. elliptic), number of ovules in each locule (2 vs. 1), and bigger fruits (4–6.8 × 2.6 × 2.1 cm vs. 2.4–2.7 × 1.6–2.2 × 1.1 cm). *Peritassa sadleri* is also very similar to *Peritassa longifolia* here described: the flowers are almost identical, but the two species differ in habit (small tree vs. liana), size of the pedicels (1.2–1.7 mm vs. 2.9 mm), and by different fruits (mature 4–6.8 × 2.6 × 2.1 cm, ellipsoid vs. immature 3.4–4.8 × 2.8–4.2 cm, subpyriform).

Paratypes. BRAZIL. **Espírito Santo:** Brejetuba [in sched. 'Brejatuba'], Rancho Dantas, 22 Oct. 2000, *G. Hatschbach, M. Hatschbach & J. M. Silva 71523* (BHCB [2], MBM); Itarana, Jatiboca, Alto de Jatiboca, 3 km da Vila Jatiboca, Fazenda da familia Seidler [sic], 19°51′S, 40°52′W, 14 Feb. 1999, *E. M. NicLughadha 204, R. Mello-Silva, B. L. Stannard & M. C. Assis* (BHCB, K not seen, MBML, SPF).

Peritassa longifolia Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, 750 m, 28 Nov. 2001, *L. Kollmann 5055, E. Bausen & W. Pizziolo* (holotype, MBML; isotype, BHCB). Figure 2.

Peritassae mexiae disco brevi-tubulari et antherarum dehiscentia transversali-obliqua affinis, sed foliorum forma, florum colore, petalis orbicularibus, ovulorum numero et fructuum dimensione differt. Etiam *Peritassae sadleri* hic descriptae affinis, sed habitu, pedicelli dimensione et fructuum forma et dimensione differt.

Lianas, glabrous, branches terete, lenticellate, sulcate, smooth. Leaves opposite; stipules not seen, caducous; petioles 0.7–0.9 cm, canaliculate; blades 7.5–17.7 × 1.9–4.3 cm, elliptic, chartaceous, drying cinereous, opaque, the base cuneate, the apex acuminate, tip apiculate, the margin entire and thickened, venation brochidodromous with veins slightly prominulous on both sides. Inflorescence thyrsoid-paniculate, 1.1–1.8 × 1.1–1.8 cm, with ca. 15 flowers, axillary; bracts 0.4–0.6 mm long, triangular, the margin entire; peduncle obsolete; inflorescence branches arising from an axillary tuft of six triangular scales; branches opposite or alternate, terete; pedicels 2.9 mm long, terete, minutely punctulate; bracteoles 2, opposite at base or middle of pedicel, triangular, 0.3 mm long. Flowers green, 4.6 mm wide at anthesis; sepals 5, 0.8–0.9 × 1.2–1.3 mm, triangular or elliptic, unequal, ± carnose, the margin minutely erose; petals 5, 1.9–2.1 × 2 mm, ± circular, ± carnose, spreading at anthesis, the margin entire to minutely erose; disc annular, short-tubular, ca. 0.3 mm high, 0.2 mm thick, carnose, free from reproductive parts, the margin entire; stamens 3, ca. 0.7 mm long, in open flower exserted and reflexed, the filaments flattened, the connective adaxially thickened, darkened when dry, not surpassing the thecae, the anthers ca. 0.22 × 0.48 mm, oblong, slightly emarginate at base, basifixed, dehiscence extrorse by almost transverse apical slits; pistil 0.6 × 0.7 mm, conical, ovary slightly 3-lobed, 3-locular, with 2 subapical ovules in each locule, style ca. 0.3 mm long after anthesis,

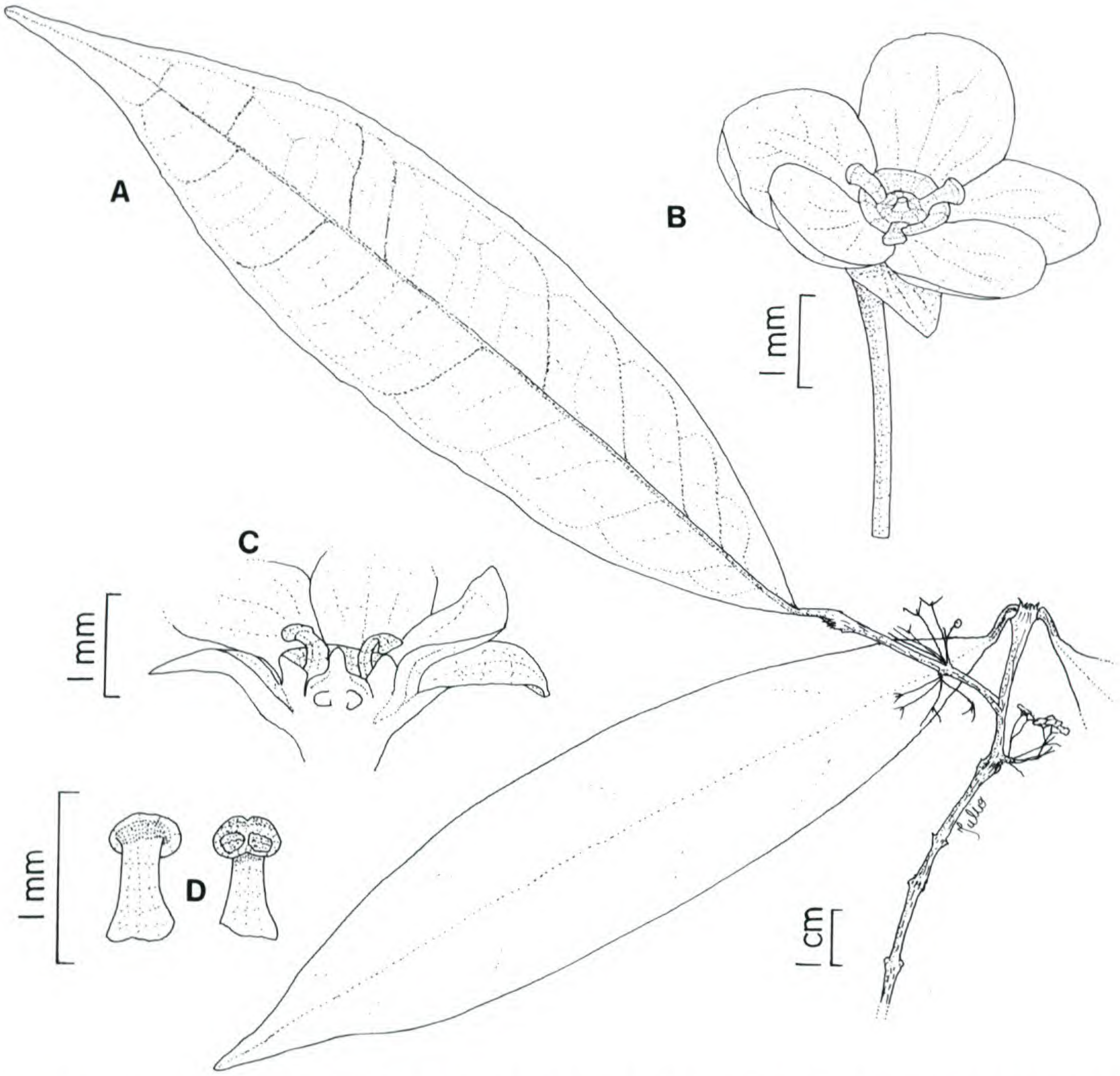

Figure 2. *Peritassa longifolia* Lombardi. —A. Branch with leaves and inflorescences. —B. Lateral view of flower. —C. Lateral view of middle section of open flower showing disc, two stamens, and pistil. —D. Adaxial and abaxial views of stamens. Drawn from the isotype *Kollmann 5055 et al.* (BHCB).

central, terete; stigmas obscure. Mature drupes not seen, immature drupes 3.4–4.8 × 2.8–4.2 cm, ± pyriform, the epicarp crustaceous, smooth, drying brown-pruinose, minutely alveolate; seeds ca. 5, 2.3 × 1 cm, reniform.

Phenology. Collected with flowers in November; collected with immature fruits in April and May.

Distribution and habitat. Peritassa longifolia occurs at altitudes of ca. 700 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil, and is known only within the limits of the Augusto Ruschi Biological Reserve, an area with 4000 ha of primary rain forest. This area is one of the few intact and relatively large forest fragments in Espírito Santo. The Biological Reserve provides protection for this species, although the population status is unknown.

This new species resembles *Peritassa mexiae* by the disc, stamens, and pistil, and the dried leaf color and texture, but may be distinguished by the blade apex (acuminate vs. acute), smaller inflorescences (1.1–1.8 × 1.1–1.8 cm vs. (0.8–)2.3–5.0 × (0.8–)2.8–7.1 cm), color of flowers (green vs. yellow), shape of petals (± circular vs. elliptic), number of ovules in each locule (2 vs. 1), and bigger fruits (immature 3.4–4.8 × 2.8–4.2 cm vs. mature 2.4–2.7 × 1.6–2.2 × 1.1 cm). *Peritassa longifolia* is also similar to *Peritassa sadleri* described herein, with the almost identical flowers. However, the two species are distinguished by their habit (liana vs. small tree), by the bigger pedicels (2.9 mm vs. 1.2–

1.7 mm), and by different fruits (immature 3.4–4.8 × 2.8–4.2 cm, subpyriform vs. mature 4–6.8 × 2.6 × 2.1 cm, ellipsoid).

Paratypes. BRAZIL. **Espírito Santo:** Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, 8 May 2002, *R. R. Vervloet 230 & E. Bausen* (BHCB, MBML); trilha Roda D'Água, 2 Apr. 2002, *R. R. Vervloet 53, E. Bausen & W. Pizziolo* (BHCB, MBML).

Comments on the two Peritassa *species described herein.* The transversally dehiscent anther locule and inconspicuous connective group *Peritassa longifolia* and *P. sadleri* with *P. calypsoides* (Cambessèdes) A. C. Smith, *P. mexiae*, and the former *Tontelea glabra*, whose combination in *Peritassa* is here proposed; these five species stand apart from remaining *Peritassa* species by their almost transverse anther dehiscence slits and connective not exceeding thecae. However, an intermediary morphology is found in *P. hatschbachii* Lombardi, with its oblique anther dehiscence slits and a connective which slightly or not at all surpasses the thecae.

Salacia nemorosa Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, Res. Biol. Santa Lúcia, trilha do palmiteiro, 27 Jan. 2000, *V. Demuner 621 & E. Bausen* (holotype, MBML; isotype, BHCB). Figure 3.

Inter species austro-orientales Brasilienses inflorescentia forma singulari distincta. *Salaciae mosenii* disci forma similis, sed disci externa margine sulco praedito, floribus maioribus et fructibus minoribus pyriformibus distincta.

Trees, ca. 10–12 m, DBH 35 cm, glabrous, branches terete, lenticellate, sulcate, smooth, with seasonal growth marked by scale-like cataphylls. Leaves opposite; stipules 0.6 mm, persistent, triangular, margin denticulate; petioles 0.6–0.7(–0.8) cm, canaliculate; blades (8–)8.9–10.6 × 3–4(–4.9) cm, elliptic, chartaceous, drying brown, the base cuneate, the apex acuminate or acute, tip slightly emarginate, the margin entire and thickened, cream-colored when dry, venation brochidodromous with veins slightly prominulous on both sides, cream-colored when dry. Inflorescence thyrsoid-paniculate, 1.8–2.8 × 1–2.5 cm, with ca. 18 flowers, axillary at leafless nodes; bracts 0.7–1.3 mm long, triangular, the margin erose; peduncle 0.8–1.3 cm, terete, all branches opposite, terete; pedicels (1.9–)2.9 mm long, terete, minutely punctuate; bracteoles 2, opposite at base of pedicel, triangular, 0.7 mm long. Flowers yellow, 4.7 mm wide at anthesis; calyx synsepalous, sepals 5, lobes 0.5 × 1 mm, triangular or elliptic, coriaceous, the margin entire, involute; petals 5, 2.2 × 1–1.2 mm, elliptic, ± chartaceous, spreading at anthesis, the margin undulate; disc ca. 0.6 × 0.4 mm, conical, carnose, free from reproductive parts, the margin grooved, entire; stamens 3, ca. 1 mm long, at first appressed together around pistil, after exserted and reflexed, the filaments flattened, the connective adaxially thickened, the anthers ca. 0.17 × 0.4 mm, oblong, slightly emarginate at apex, basifixed, dehiscence extrorse by oblique almost transverse apical slits; pistil 0.65 × 1 mm, conical, ovary 3-lobed, 3-locular, with 2 axillary ovules in each locule, style ca. 0.5 mm long after anthesis, central, conical, 3-angled, stigmas obscure. Immature drupes 5.4 × 3.5 cm, pyriform, sometimes ribbed at base, the epicarp crustaceous, drying brown-pruinose, minutely rugose; seeds 1 or 2, 2.8 × 2.3 × 1.5 cm, reniform.

Phenology. Collected with flowers in January; collected with immature fruits in October.

Distribution and habitat. *Salacia nemorosa* occurs at altitudes of ca. 650–850 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil. This taxon is known only from Santa Teresa municipality, which includes the Santa Lúcia and Augusto Ruschi Biological Reserves, areas with 2500 and 4000 ha, respectively, of primary and secondary rain forests inside the city limits. The biological reserves provide adequate protection for this species, which have reproductive populations in different places in Santa Teresa.

This new species is distinguished from all other southeastern Brazilian species by its pedunculate inflorescence; *Salacia elliptica* (Martius ex Schultes) G. Don, *Salacia crassifolia* (Martius ex Schultes) G. Don, and *Salacia grandifolia* (Martius ex Schultes) G. Don have fasciculate inflorescences, while *Salacia mosenii* A. C. Smith has chiefly sessile thyrsoid-paniculate inflorescences and *Salacia arborea* (Schrank) Peyritsch has simple or compound dichasia. It resembles *Salacia mosenii* in its conic disc, but it differs because the disc has a flattened outer margin instead of a groove and larger flowers (4.7 mm vs. 2.4–4.3 mm) and different fruit shape (pyriform vs. spherical).

Paratypes. BRAZIL. **Espírito Santo:** Santa Teresa, Alto São Lourenço, Sítio da Cachoeira, 25 Oct. 2000, *V. Demuner 1490, E. Bausen & W. Pizziolo* (BHCB, MBML); Santa Teresa, Est. Biol. de Santa Lúcia, 22 Sep. 1993, *L. D. Thomaz 1722* (BHCB, MBML); Santa Teresa, Res. Biol. Augusto Ruschi, estr. Alto Goiapaba–Açu, 10 Jan. 2002, *L. Kollmann 5294 & E. Bausen* (BHCB, MBML), 10 Jan. 2002, *L. Kollmann 5299 & E. Bausen* (BHCB, MBML); trilha da cachoeira, 29 Jan. 2002, *L. Kollmann 5361 & E. Bausen* (BHCB, MBML); Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, estr. Goiapaba–Açu, 24 Oct. 2002, *R. R. Vervloet 1272, E. Bausen & W. Pizziolo* (MBML).

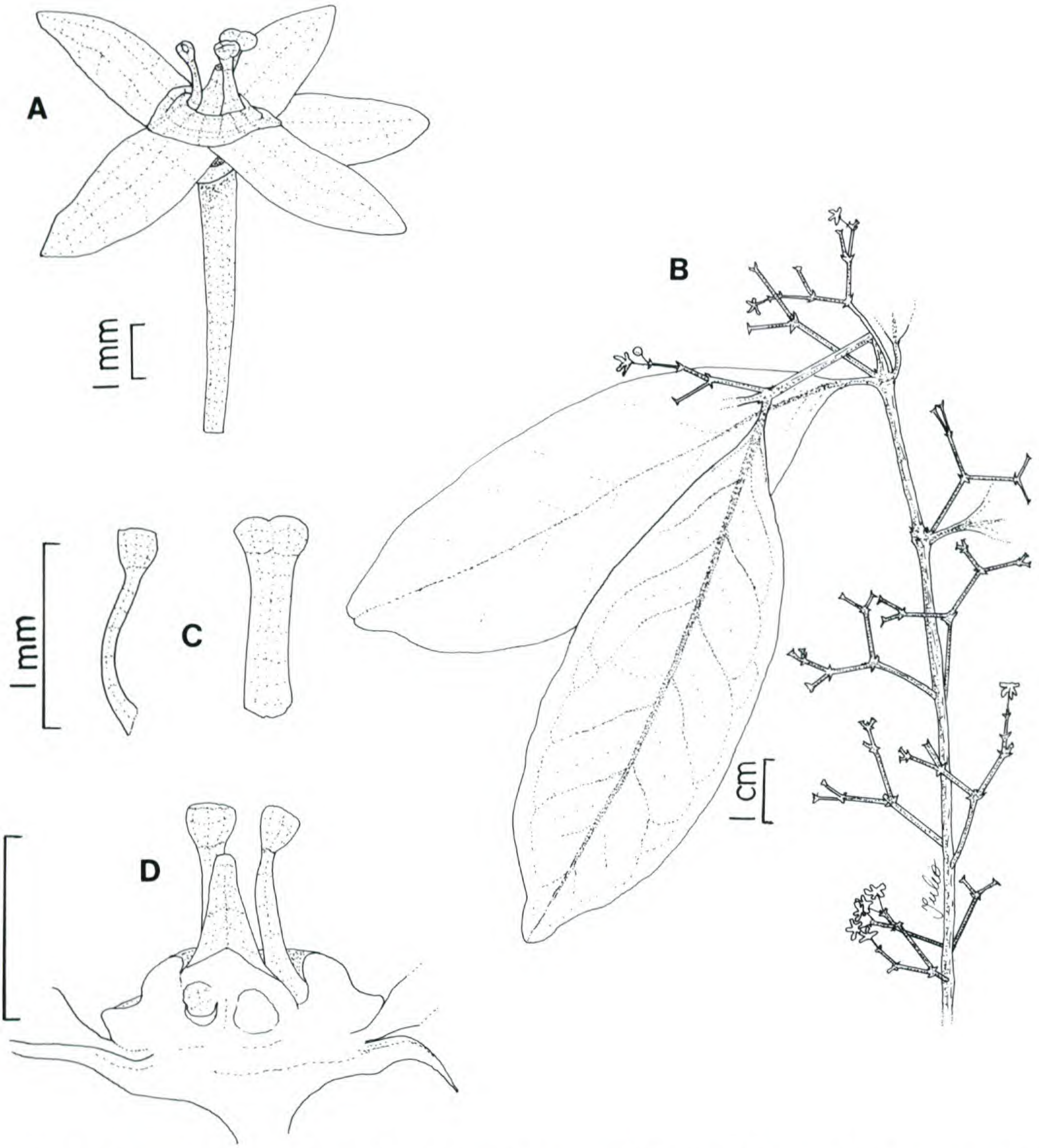

Figure 3. *Salacia nemorosa* Lombardi. —A. Lateral view of flower. —B. Branch with leaves and inflorescences. —C. Lateral and adaxial views of stamens. —D. Lateral view of middle section of open flower showing disc, two stamens, and pistil. Drawn from the isotype *Demuner 621 & Bausen* (BHCB).

In addition to the aforementioned novelties, a new combination is proposed.

Peritassa glabra (A. C. Smith) Lombardi, comb. nov. Basionym: *Tontelea glabra* A. C. Smith, Brittonia 3: 500. 1940. TYPE: Bolivia. La Paz: San Carlos, Mapiri region, 850 m, 5 Feb. 1927, *O. Buchtien 1728* (holotype, NY; isotype, F).

Smith (1940) revised the Hippocrateoideae (as Hippocrateaceae) from the Neotropics, recognizing 115 species, including *Peritassa mexiae* A. C. Smith and *Peritassa calypsoides* (Cambèssedes) A. C. Smith. These species have an inconspicuous anther connective and oblique dehiscence clefts, almost transverse, and are distinguished from other fleshy-fruited genera (tribe Salacieae, Mennega, 1997) because the anther locules, although dehiscent by transversal clefts, are not confluent at the apex. The type of *Peritassa calypsoides* was not studied by Smith, who confused this species with a previously undescribed *Peritassa* species, *P. hatschbachii* Lombardi (Lombardi & Temponi,

1999). *Peritassa mexiae* was described based on a single specimen with detached "imperfect" flowers found between the inflorescence branches (Smith, 1940: 518). I examined the isotype specimens (*Y. Mexia 5206*, A, BM, F, GH, NY, VIC), and the flowers referred to by Smith appear to be older dried flowers that had fallen between the inflorescence branches and remained on the sheet. At the same time, Smith described *Tontelea glabra* A. C. Smith (1940: 500), but did not perceive the similarity of this species with *Peritassa mexiae*. I went through the types of *Tontelea glabra* and a number of Amazonian collections from several herbarium collections (CTES, F, IAN, IPA, MG, NY, R, RB, S, U, UB, US) and did not encounter the anther character of "confluent horizontal apical clefts" (Smith, 1940: 501) used by the author for inclusion of this taxon in *Tontelea*.

Tontelea in Smith's (1940: 355) key is distinguished from *Peritassa* by the dehiscence of anthers by confluent slits, while *Peritassa* dehiscence was by non-confluent slits. Almost all species in *Tontelea* have oblong, relatively large anthers (0.2–0.4 × 0.3–0.6(0.8) mm) with clearly transverse dehiscence slits and 3-lobed stigmas, alternate or opposite with stamens, except for the aberrant species *Tontelea cylindrocarpa*, *T. myrsinoides*, *T. nectandrifolia*, and *T. glabra*, which have relatively smaller anthers (0.1–0.3 × 0.2–0.3(0.5) mm) and unlobed stigmas. The transfer of *T. glabra* to the genus *Peritassa* diminishes the morphological discrepancy within *Tontelea*; the generic placement of the other three divergent species remains to be studied.

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The Australian *Alyogyne cravenii* Transferred to *Hibiscus* (Malvaceae)

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Abstract. *Alyogyne cravenii* Fryxell (Malvaceae) is transferred to *Hibiscus cravenii* (Fryxell) B. E. Pfeil & Craven on account of character information from the chloroplast, nucleus, and morphology. These data do not place *A. cravenii* with its congeners *A. hakeifolia*, *A. huegelii*, and *A. pinoniana*, instead placing it with *H.* sects. *Bombicella* and *Hibiscus*.

Key words: *Alyogyne*, Australia, *Hibiscus*, Hibisceae, Malvaceae.

In 1987, Fryxell published a new species in *Alyogyne* (*A. cravenii*) from the Keep River area in the Northern Territory of Australia. This species was based on two collections, the holotype *Fryxell, Craven & Stewart 4870* and *Craven 8462* (details in Fryxell, 1987). Since then two additional collections of *A. cravenii* from the same area have been made, i.e., *Egan 5027* and *Cowie 7726*.

Our investigations into the phylogenetic history of the tribe Hibisceae (Malvaceae) prompted us to examine DNA sequence variation among several *Alyogyne* and *Hibiscus* species (Pfeil et al., 2002). Unexpectedly, chloroplast DNA sequences from two regions (the *ndh*F gene and the *rpl*16 intron) generated from living material of the type collection of *A. cravenii* did not group this species with three of its congeners, *A. hakeifolia*, *A. huegelii*, and *A. pinoniana* (Pfeil et al., 2002). Instead, *A. cravenii* was placed in a clade with several species of *Hibiscus* sect. *Bombicella* and *H.* sect. *Hibiscus*. This result was well supported by bootstrap resampling (Pfeil et al., 2002) and appears to be robust in differing analysis methods (i.e., parsimony and maximum likelihood; Pfeil et al., in prep.).

Further morphological examination revealed four characters shared by the three *Alyogyne* species mentioned above, but not by *A. cravenii*, while *A. cravenii* shares a number of features with all other *Hibiscus* species studied so far (Pfeil et al., 2002). These characters are summarized in Table 1. One feature that helps distinguish *Alyogyne* from *Hibiscus* is the unitary style in the former, which was reported from *A. cravenii* ("style single," Fryxell, 1987: 279). However, this observation appears to be erroneous, as our examination of the holotype material cited in the first publication, and other collections (*Egan 5027*, *Cowie 7726*, which are in every respect similar to the type collection), has revealed distinct styles in all cases.

Further DNA sequence examination of a low-copy nuclear gene, RNA polymerase II 2nd largest subunit (*rpb*2), also places *A. cravenii* sequences within a clade containing sequences from *Hibiscus* sects. *Bombicella* and *Hibiscus*, and not among its congeners (Pfeil et al., 2004).

Table 1. Characters that distinguish *Alyogyne* and *Hibiscus*.

Character	State in *Alyogyne*	State in *Hibiscus* and *A. cravenii*
Staminal column terminal sterile tissue or teeth	absent	present
Styles	connate throughout	free distally
Stigmas	lobed/flat or club-shaped	capitate
Endosperm	copious	reduced

Conclusion

As three independent sources of characters all agree in placing *Alyogyne cravenii* within *Hibiscus*, the current generic placement cannot be maintained. Therefore, we transfer this species to *Hibiscus*, as *H. cravenii*. As the sectional boundaries in *Hibiscus* are currently under revision, this species will not be placed in a section, although on the basis of foliar and floral morphology it appears closely related to several Australian species considered part of *H.* sect. *Bombicella*, i.e., *H. setulosus*, *H. leptocladus*, and *H. geranioides*.

Hibiscus cravenii (Fryxell) B. E. Pfeil & Craven, comb. nov. Basionym: *Alyogyne cravenii* Fryxell, Syst. Bot. 12: 277. 1987. TYPE: Australia. Northern Territory: Keep River, in dissected sandstone hills W of river, ca. 30 km E of Kununurra, 15°48′S, 129°04′E, 20 June 1985, *P. A. Fryxell, L. A. Craven & J. McD. Stewart 4870* (holotype, CANB; isotypes, DNA, AD, BH, K, L, MARY, MEL, NY, PERTH, TEX, US).

Selected specimens examined. AUSTRALIA. **Northern Territory:** Keep River NP, Jarrnam area, 15°45′36″S, 129°05′03″E, 8 June 1995, *Egan 5027* (CANB [seen]; [DNA not seen]); Keep River NP, valley W of Garrandalng, 15°51′43″S, 129°02′29″E, 31 May 1998, *Cowie 7726* (CANB [seen]; DNA, MEL, PERTH [not seen]).

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Wikstroemia fuminensis (Thymelaeaceae), a New Species from Yunnan, China

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ABSTRACT. A new species, *Wikstroemia fuminensis* Y. D. Qi & Y. Z. Wang, is described and illustrated. The type specimen was collected from Mt. Maying of Fumin County, Yunnan Province. The new species is distinct in section *Wikstroemia*. Based on the glabrous pentamerous flower and head-like inflorescence, it is somewhat similar to *W. fargesii* (Lecomte) Domke and *W. huidongensis* C. Y. Chang, but differs in its inflorescence without peduncle, floral size (compared with *W. huidongensis*), glabrous ovary, and plant habit (compared with *W. fargesii*).

Key words: China, Thymelaeaceae, *Wikstroemia*.

The genus *Wikstroemia* Endlicher, with about 70 species, is widely distributed in eastern Asia, Malesia, and the islands in the Pacific. In China, the genus, represented by 44 species, mainly occurs in southern China, especially in the Hengduan Mountains. *Wikstroemia* is considered to be closely related to *Daphne* (Hou, 1960; Tan, 1980; Dute et al., 1996). The delimitation of the two genera is usually based on the shape of the disc and phyllotaxy, i.e., a scale-like disc and opposite leaves in *Wikstroemia* and an annular or cup-shaped disc and alternate leaves in *Daphne*. Even though there are transitional forms in the shape of the disc and the phyllotaxy, most species of *Wikstroemia* can be clearly identified based on their membranous scale-like disc, smaller flowers, and shorter floral lobes.

The unusual new species described here was found during our revision of the Chinese Thymelaeaceae. We recognize it as a distinct species belonging to *Wikstroemia*, after checking specimens of those species close to it in KUN and PE.

Wikstroemia fuminensis Y. D. Qi & Y. Z. Wang, sp. nov. TYPE: China. Yunnan: Fumin County, Yongding District, Mt. Maying, on shrubby slope, 2700 m, 20 Oct. 1964, *Bin-Yun Qiu 596135* (holotype, KUN; isotype, PE). Figure 1.

Species nova *W. huidongensi* et *W. fargesii* affinis; ab illa differt floribus 6–10 fasciculatis pedunculo non manifesto, tubo floris 11–13 mm longo, pistillo 2.5–3 mm longo, ab hac differt floribus fasciculatis pedunculo non manifesto, foliis densis, ovario glabro.

Shrub up to 0.8–1.2 m tall; young branches light green, old ones dark purple-brown, glabrous. Leaves opposite or subopposite, densely arranged on the branchlets, papyraceous, ovate or broad-ovate, 1.7–3 × 0.7–1.4 cm, apex acute, rarely obtuse, base rounded or slightly attenuate, entire, margins of dry leaves slightly revolute, adaxial surface green or brown, abaxial surface light green or brown, glabrous, midrib concave adaxially and elevated abaxially, lateral nerves in 5 to 7 pairs, inconspicuous adaxially and conspicuous abaxially, petioles very short, ca. 1–2 mm long. Flowers 6 to 10, constituting a terminal head without peduncle, yellow, glabrous, pedicel short, ca. 1 mm long. Perianth cylindrical, tube ca. 11–13 mm long, 5-lobed, lobes ovate to ovate-elliptic, obtuse, 2–2.5 mm long. Stamens 10 in 2 series inserted on the tube, the upper 5 on the throat and the lower 5 on the middle part of the tube, 1–1.2 mm long. Disc scale-like, membranous, 2 mm long, apex irregularly deep or shallow-lobed. Pistil 2.5–3 mm long, ovary ellipsoid, glabrous, style short, 0.2 mm long, stigma globose, papillate.

Flowering in October; fruit not seen.

Specimens of this species were originally identified as *Daphne aurantiaca* Diels. However, its pentamerous flower is distinctively different from the tetramerous flower of *D. aurantiaca*. Domke (1932) transferred *D. aurantiaca* into the genus *Wikstroemia* (*W. aurantiaca* (Diels) Domke) because of its pentamerous flower, long style, and scale-like disc. Stapf (1933) and Hamaya (1963) noted that Domke might have confused the numbers of floral lobes and stamens. We also found all specimens of *D. aurantiaca* were tetramerous, without exception. At the same time, Hamaya (1963) mentioned that *D. aurantiaca* showed close affinity to *Daphne* based on characteristics of its wood anatomy, such as the lack of internal phloem in the leaves and

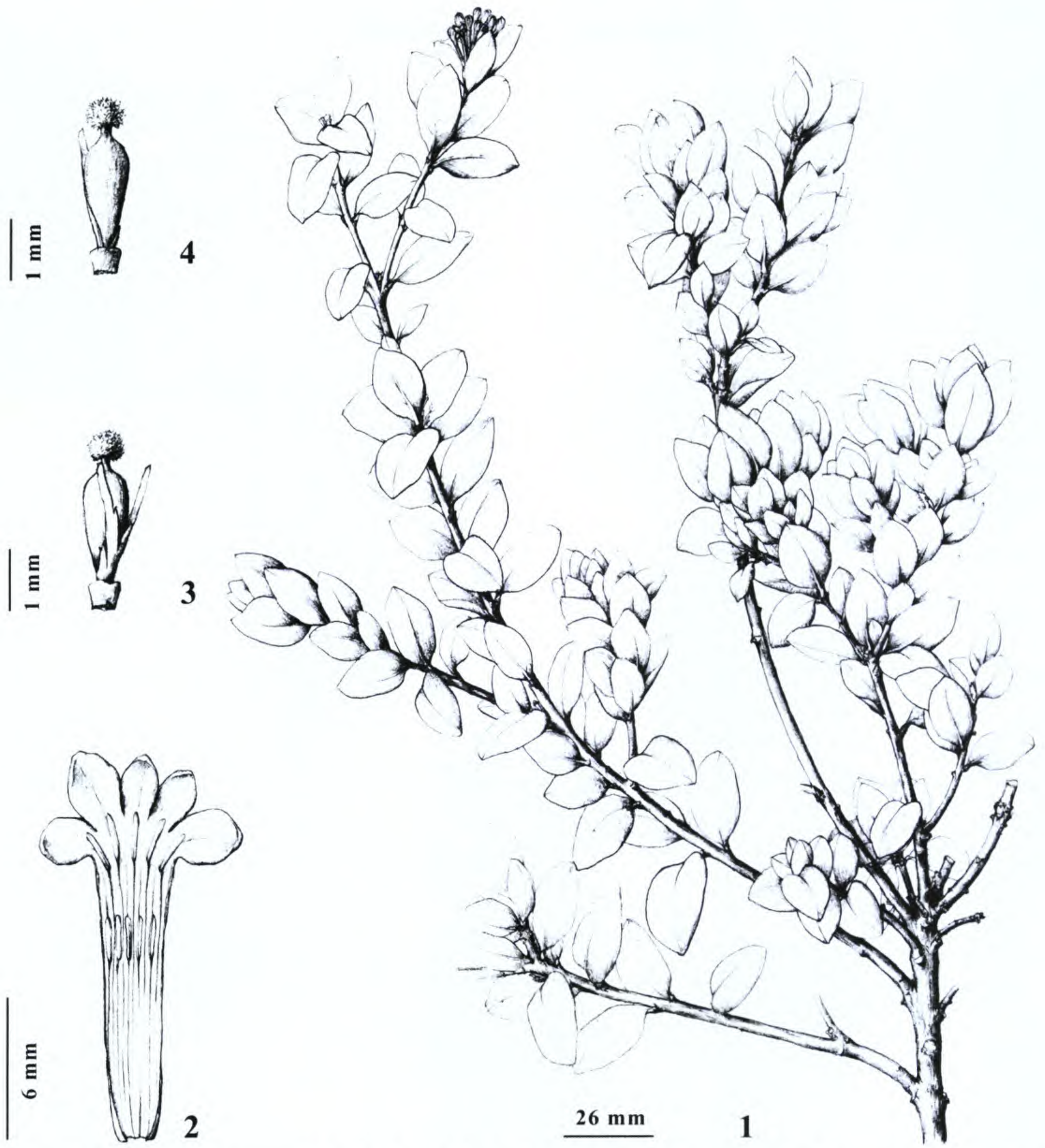

Figure 1. *Wikstroemia fuminensis* Y. D. Qi & Y. Z. Wang. —1. Habit. —2. Perianth and stamens. —3. Pistil and scale-like disc, lateral-abaxial view. —4. Pistil and scale-like disc, lateral-adaxial view. (Drawn from the KUN holotype *Bin-Yun Qiu 596135.*)

the pattern of distribution of tracheal elements in the wood. Although Hamaya's evidence supported *D. aurantiaca* as a member of *Daphne*, the species is more similar to *Wikstroemia* than to *Daphne* on external morphological characteristics, such as its scale-like disc and opposite leaves. Therefore, its systematic position remains in question. But *W. fuminensis* obviously differs from *D. aurantiaca* (see Table 1), and undoubtedly belongs to *Wikstroemia* based on its scale-like disc, opposite leaves, and shorter floral lobes.

According to the classification of Huang (1985), *Wikstroemia fuminensis* belongs in section *Wikstroemia* because of its glabrous flowers and head-like inflorescence. After we checked specimens and literature of pentamerous species in this section, we believed that *W. fuminensis* resembled *W. huidongensis* and *W. fargesii*. Although we had no specimens of these two species, we checked the original description (Lecomte, 1916; Chang, 1986), type photograph (the type of *W. fargesii* was deposited in NY), and figures (Chang, 1986). We found that

Table 1. Character differences between *Wikstroemia fuminensis* and *Daphne aurantiaca*.

	Number of floral lobes	Number of flowers in inflorescence	Leaf size (cm)	Flowering time
W. fuminensis	5-merous	6 to 10	1.7–3 × 0.7–1.4	October
D. aurantiaca	4-merous	2 to 4	0.8–2.3 × 0.4–1.2	May–July

the new species differed in several key characters, such as its sessile inflorescence, floral size, glabrous ovary, and plant habit (see diagnosis).

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A New and Endangered Species of *Hyperacanthus* (Rubiaceae) from Madagascar: *H. mandenensis*

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ABSTRACT. *Hyperacanthus mandenensis* Rakotonasolo & A. P. Davis is described as a new species on the basis of its large corolla (10.5–16.5 cm long), included style, and thick fibrous fruit wall (6–10 mm thick). No other species of *Hyperacanthus* E. Meyer ex Bridson possess these characters: *H. ambovombensis* Rakotonasolo & A. P. Davis, *H. amoenus* (Sims) Bridson, *H. grevei* Rakotonasolo & A. P. Davis, and *H. microphyllus* (K. Schumann) Bridson all have small corolla tubes (less than 5 cm long), a style that is positioned more or less level with the corolla throat, and a thin non-fibrous fruit wall (less than 3 mm thick). *Hyperacanthus mandenensis* is restricted to the forests of Petriky, Mandena, and St. Luce, in an area corresponding to a proposed mining site, in southeastern Madagascar (Toliara Province). Using the IUCN Red List Category criteria, *H. mandenensis* is currently assessed as Endangered, although without appropriate conservation measures this species would easily become Critically Endangered, or even Extinct.

Key words: conservation, Gardenieae–Gardeniinae, *Hyperacanthus*, ilmenite, IUCN Red List Categories, Madagascar, mining and conservation, Rubiaceae.

The genus *Hyperacanthus* is a member of the tribe Gardenieae DC. subtribe Gardeniinae DC., with a geographical range covering southeastern tropical Africa and Madagascar. It currently comprises four species, two from Madagascar (*H. ambovombensis* and *H. grevei*; Rakotonasolo & Davis, 2001, 2002) and two from Africa (*H. amoenus* and *H. microphyllus*; Bridson & Robbrecht, 1985). It has been estimated (Davis & Bridson, 2003; Davis & Rakotonasolo, 2003) that there are about 30 species of *Hyperacanthus* in Madagascar, although more recent investigations by the first author (as part of an in-depth study of the genus, F. Rakotonasolo, unpublished data 2004) indicate that are about 50 species in Madagascar. The salient characteristics of the genus are: stipules caducous, tightly rolled and often slightly twisted; leaves lacking domatia; inflorescences terminal but often appearing axillary (overtopped) due to shoot extension; paired bracteoles at the base of the calyx and fruit; corolla lobes overlapping to the right in bud; ovary 2- or 4-locular with axile placentation, sometimes with additional basal septa (with parietal placentation); anthers more or less sessile or with very short filaments (ca. 0.1 mm long); and calyx persistent and obvious in fruit. In the past, *Hyperacanthus* has been confused with *Genipa* L., *Gardenia* J. Ellis, and particularly *Rothmannia* Thunberg, but in reality these four genera are clearly very different (Rakotonasolo & Davis, 2002).

A third species of *Hyperacanthus* for Madagascar is described here: *H. mandenensis* Rakotonasolo & A. P. Davis. The description of this species has been prompted by the realization that it could be in danger of extinction due to the likely onset of mining and associated activities in the Taolagnaro (Fort Dauphin) region of southeastern Madagascar.

Hyperacanthus mandenensis is easily separated from the other four described species of *Hyperacanthus* on the basis of its large corolla (10.5–16.5 cm long), included style, and thick fibrous fruit wall (0.6–1 cm thick). *Hyperacanthus ambovombensis*, *H. amoenus*, *H. grevei*, and *H. microphyllus* all have small corolla tubes (less than 5 cm long), a style that is positioned more or less level with the corolla throat, and a thin non-fibrous fruit wall (less than 3 mm thick). *Hyperacanthus mandenensis* also has a larger fruit than the other *Hyperacanthus* species: 2.6–3.7 cm diam. as opposed to less than 2 cm diam. In addition, *Hyperacanthus mandenensis* can be separated from *H. amoenus*, *H. microphyllus*, and *H. ambovombensis* because it has a 4-locular ovary, a characteristic it shares with *H. grevei*. *Hy-*

peracanthus amoenus and *H. microphyllus* have a 2-locular ovary with two additional parietal attachments in the basal half of the ovary (Bridson & Robbrecht, 1985), the ovary thus being 4-locular at the base (Rakotonasolo & Davis, 2002); *H. ambovombensis* has a 2-locular ovary.

Materials and Methods

Herbarium material of this species was consulted at the Royal Botanic Gardens, Kew (K), the Muséum National d'Histoire Naturelle, Paris (P), Recherches Forestières et Piscicoles, Antananarivo (TEF), and Département de Botanique, Parc de Tsimbazaza, Antananarivo (TAN). Field studies were undertaken by us in 2001, and by F. Rakotonasolo in 2002. The measurements and other details given in the description are based on herbarium specimens, material preserved in spirit, and field study.

The conservation status of each species was assessed by calculating the extent of occurrence and area of occupancy using a GIS (J. Moat, pers. comm.) and applying the IUCN Red List Category criteria (IUCN, 2001). The distribution data was analyzed using the methodology and software developed by Willis et al. (2003). Supporting information was provided from field studies.

Description of *Hyperacanthus mandenensis*

Hyperacanthus mandenensis Rakotonasolo & A. P. Davis, sp. nov. TYPE: Madagascar. Toliara: Taolagnaro Prefecture, Mandena Forest, forest parcel M15, 30 m, 15 Feb. 2001, *A. P. Davis & F. Rakotonasolo 2719* (holotype, TAN; isotypes, BR, K, P, MO, TEF). Figure 1.

Affinis *H. amoeno* sed spinis carentibus, floribus majoribus (corolla 10.5–16.5 cm longa nec 1.5–5 cm longa), antheris et stylo inclusis (non exclusis), ovario et fructu tetralocularibus (non per partem maiorem bilocularibus), pericarpio crasso (0.6–1 cm nec 0.1–0.2 cm), differt.

Tree or small tree, 4–14 m high, DBH 5–14 cm; bark ± smooth, gray to dark brown; branches scaly, gray to brown; branchlets cylindrical, 3.9–6.5 mm diam., smooth (young) or ± smooth to rugose (old), brown to dark brown, ± glabrous; stipules caducous or semi-persistent at the apex of the branches, adnate, ± inrolled and pressed together at the base, deltate to triangular, 1.1–1.4 × 2–2.3 mm, glabrous, apex attenuate to acuminate. Leaves with petiole 0.7–1.7 cm long; leaf blade elliptic to oblong, 3.5–12 × 1.5–4.5 cm, coriaceous, surfaces ± concolorous, base acute to cuneate, margins subrevolute to flat, apex acute to obtuse; abaxial surface glabrous, midrib prominent but becoming flat from base to apex, secondary nerves 5 to 7 pairs, manifest to indistinct, ascending at an angle 45° to 60°, curved near the margin and joining the next (i.e., brochidodromous), tertiary venation indistinct; adaxial surface slightly shiny, glabrous, venation less clearly manifest than the abaxial surface. Inflorescence initiated in a terminal position but overtopped and then appearing axillary in the second or third node from apex, 1(to 2)-flowered, sessile or shortly pedunculate; peduncle 0.5–1 mm long. Flowers 5-merous, sessile or shortly pedicellate, pedicel(s) 0.5–1.5 mm long; bracteoles 2, located at the base of the calyx, adnate from the base to ⅓–½ their length, broadly ovate to ± ovate, 2–2.4 × 1.5–2 mm, internal surface pubescent, external surface glabrous, margins pubescent, apex acute to obtuse; calyx including hypanthium 4.2–5.5 × 3.1–4.6 mm, calyx limb tubular, 4.5–11 × 3.2–4.7 mm, external surface glabrous, internal surface pubescent to puberulous; calyx lobes ovate to deltate, 0.9–1.7 × 1.1–1.7 mm, external surface glabrous, internal surface pubescent, colleters absent, margins glabrous, each apex acuminate to apiculate, 0.4–0.6 mm long; corolla tubular, slightly funnel-shaped, 10.5–16.5 × 0.3–0.5 cm, white to greenish white; corolla throat 3.6–6 mm diam.; corolla tube 9–13.9 × 0.3–0.5 cm, white to greenish white, glabrous, internally with a diffuse ring of hairs at the base, corolla lobes narrowly elliptic to narrowly lanceolate, 2.3–2.8 × 0.4–0.6 cm, white, glabrous; anthers included, sessile, anther sacs linear, 15–18 × 0.7–1.2 mm, supramedifixed ⅓ from the apex, dorsifixed, introrse; disc annular, 0.5–0.8 mm high, glabrous; style included, narrowly cylindrical, 4.8–5.8 cm long, glabrous; stigma ⅓–½ the length of the corolla tube, bifid, lobes very narrowly elliptic to lorate, 8–17.5 × 0.9–1.5 mm, apex acute to obtuse, glabrous; ovary 4-locular, placentation axile, ovoid to spherical, 2–2.7 × 1.5–2 mm; ovules numerous per locule. Fruits ovoid to spherical 2.9–4.6 × 2.6–3.7 cm, smooth, green to yellow (living material), glabrous; fruit wall (i.e., pericarp) 0.6–1 cm thick, crunchy and rather tough (living material) to very hard and almost woody (when dry); calyx limb persistent, 3.5–6 × 3.3–4 cm long; glabrous; seeds sub-lenticular to lenticular-angular, 4.5–5.5 × 3.6–4.4 × 2.2–2.6 mm, white (living material).

Distribution. Restricted to the littoral forest of southeastern Madagascar (Toliara Province, Taolagnaro Prefecture), in the forests of Petriky, Mandena, and St. Luce.

Habitat and ecology. Humid evergreen, littoral forest; on sand or sandy soils (including stabilized

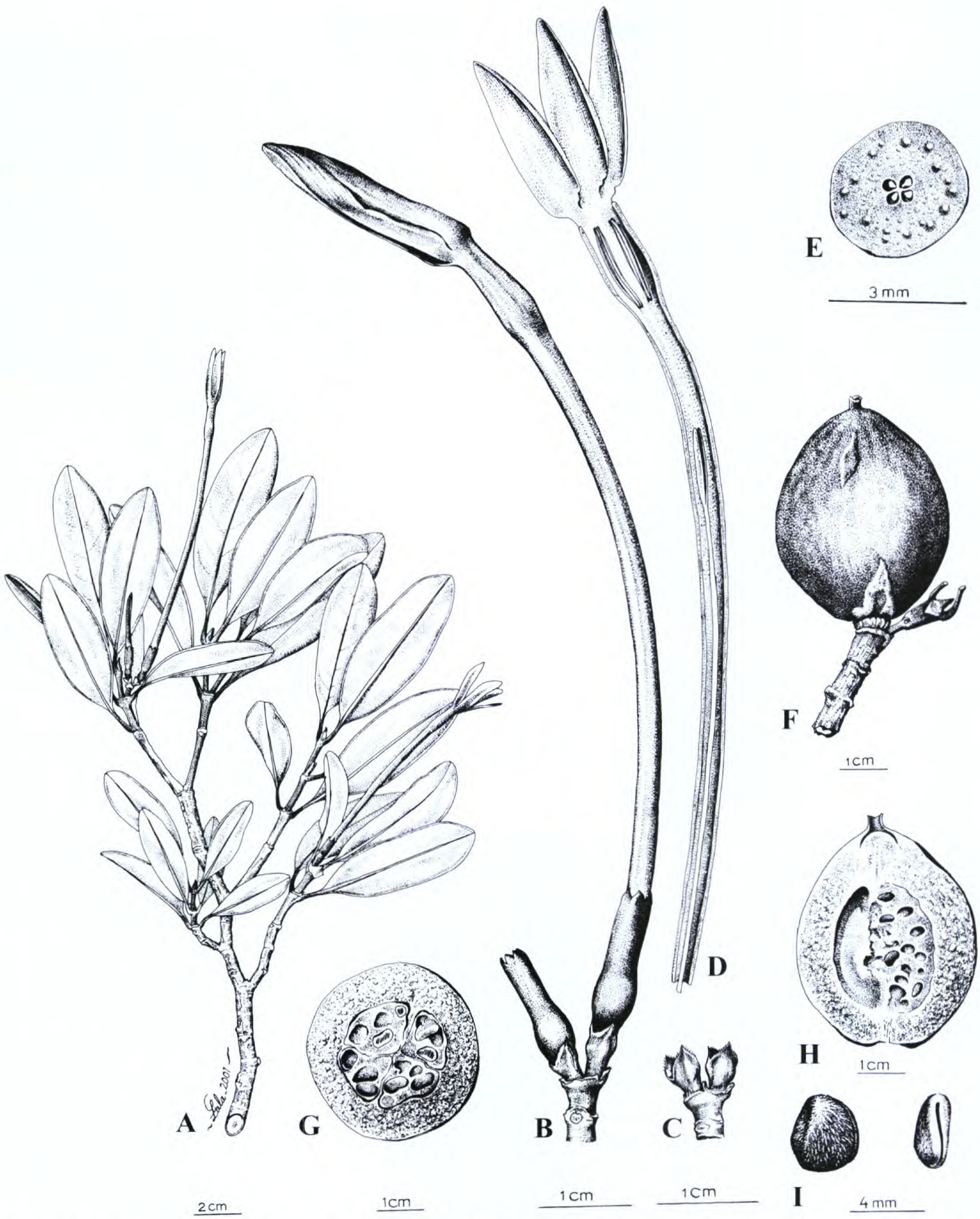

Figure 1. *Hyperacanthus mandenensis* Rakotonasolo & A. P. Davis. —A. Habit: flowering portion cut from branch. —B. Inflorescence (one corolla fallen), with each calyx (incl. hypanthium) subtended by paired bracteoles. —C. Paired bracteoles of inflorescence, calyces (incl. hypanthia) and corollas removed. —D. Corolla dissection, showing included anthers and style. —E. Transverse section through hypanthium, showing 4-locular ovary and vascular bundles. —F. Infructescence, with persistent paired bracteoles at the base of the fruit. —G. Transverse section through fruit, showing 4 locules and thick fruit wall (pericarp). —H. Longitudinal section through fruit, with persistent calyx at apex. —I. Seeds, side and end views. A–I based on *Davis & Rakotonasolo 2719*. Drawn by Roger Lala.

Karimbolian dunes) and possibly restricted to ilmenite-rich sands; sea level to 50 m.

Phenology. Flowering: September to April; fruiting: October to May.

Biology. Insufficiently known but according to Bollen (2003: 45) exclusively dispersed by the collared lemur (*Eulemur fulvus collaris* E. Geoffroy, 1812).

Conservation status. IUCN Red List Category (IUCN, 2001): **Endangered** (EN B1ab (i, ii, iii, iv, v) + 2ab (i, ii, iii, iv, v)). B1—extent of occurrence less than 5000 km² (*H. mandenensis*: 137 km²); a—severely fragmented and known to exist in no more than 5 locations (*H. mandenensis*: 22 collections, 9 geo-reference points representing 4 localities); b (i–v)—continuing decline inferred due to proposed mining and associated activities; B2—area of occupancy estimated to be less than 500 km² (*H. mandenensis*: 96.1665 km² based on seven cells of 3.7 km²).

Hyperacanthus mandenensis is restricted to the littoral forests of Mandena, St. Luce, and Petriky in the Taolagnaro (Fort Dauphin) region of southeastern Madagascar. These three littoral forest areas occur almost exclusively on ilmenite-rich sands, an area that corresponds to a proposed mining site (see ⟨www.riotinto.com⟩). The ilmenite is extracted mainly for titanium dioxide. The methods used to extract these mineral reserves lead to the complete destruction of forest cover. At the present time *H. mandenensis* is near the upper limit of the Endangered (EN) category of the IUCN Red List Categories (2001), particularly by its extent of occurrence (ca. 137 km²; see above). Even a relatively small loss of range (a reduction in the extent of occurrence to less than 100 km²) would result in an conservation assessment of Critically Endangered (CR). The extirpation of Petriky, Mandena, and St. Luce would result in the extinction of this species from the wild. A drastic reduction in the size of these forests, or severe degradation, may also cause this species to become extinct. Like many other Rubiaceae, *Hyperacanthus* rarely occurs in secondary forest.

Records of *Hyperacanthus mandenensis* (as "*Rothmannia mandenensis*") from littoral forests other than those listed above (and see locations for paratypes, below) are erroneous.

Vernacular names. Taolanana, Taholana.

Paratypes. MADAGASCAR. **Toliara Province:** Taolagnaro (Fort Dauphin) Prefecture, Manambaro, Petrika [Petriky], 5 Dec. 2002, *Rakotonasolo et al. 570* (BR, K, MO, P, TAN, TEF); Mandena mine area, 'jardin botanique,' 6 Oct. 1990, *Dumetz 1283* (K, MO, TAN); Mandena, piste SE, 7 Dec. 1989, *Dumetz & McPherson 1145* (K, MO, TAN); Mandena, 17 Apr. 1989, *Dumetz et al. 687* (TAN); Station Forestière de Mandena, 24 Mar. 1989, *Rabevohitra, Dumetz & Gereau 1793* (K, MO, TAN, TEF); Jardin Botanique de Mandena, 25–26 Oct. 1989, *Rabevohitra 2081* (K, MO, TAN, TEF); Mandena, 17–20 Mar. 1997, *Rabevohitra R.3211* (*SF 34943*) (MO, TEF); ca. 10 km NNE of Fort Dauphin (Taolagnaro), Mandena, 27 May 1991, *Zarucchi et al. 7513* (K, MO, TAN); Mandena, 21 Dec. 1952, *sine coll. 231-R-16* (TEF); Fort Dauphin, [Mandena], Sep. 1890, *Scott Elliot 3036* (K); Station Forestière de Mandena, 9 Dec. 1972, *Jacquemin 1152* (K, P); Forêt de Mandena, 16 Mar. 1985, *Dorr et al. 4002* (K, MO); St. Luce, Forêt de Marokoky, 25 Apr. 1989, *Rabevohitra, Dumetz & Gereau 1914* (K, MO, TAN, TEF); N of Fort Dauphin (Taolagnaro), near St. Luce (Manafiafy), 21 Oct. 1989, *McPherson et al. 14199* (MO, TAN, TEF); N of Fort Dauphin (Taolagnaro), St. Luce region (Manafiafy), 19 Oct. 1989, *McPherson et al. 14165* (MO, TAN); N of town (Fort Dauphin) near village of St. Luce (Manafiafy), 18 Jan. 1990, *McPherson et al. 14832* (MO, TAN); N de Manafiafy, 12 Nov. 1990, *Rabevohitra 2436* (*SF 33665*) (MO, TAN, TEF); Mantalaky, Manafiafy (St. Luce), 30 Nov. 2002, *Rakotonasolo et al. 542* (BR, K, MO, P, TAN, TEF).

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A Distinctive New Species of *Ovidia* (Thymelaeaceae) from Bolivia

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ABSTRACT. A new species from central Andean Bolivia, *Ovidia sericea* Antezana & Z. S. Rogers (Thymelaeaceae, Thymelaeoideae), is described and illustrated. This distinctive species differs from the other South American species in the genus, *O. andina* (Poeppig & Endlicher) Meisner and *O. pillopillo* (Gay) Meisner, by a number of vegetative and floral features, the most obvious being the dense sericeous indument on both surfaces of the leaf blades and the abaxial surface of the hypanthia. The description of *O. sericea* substantially extends the range of *Ovidia* Meisner, which was formerly thought to be endemic to central Chile and the adjacent Andean slopes of Argentina. A key to the species of *Ovidia* as circumscribed by Nevling is also provided.

RESUMEN. Se presenta la descripción e ilustración de una nueva especie de los Andes centrales de Bolivia, *Ovidia sericea* Antezana & Z. S. Rogers (Thymelaeaceae: Thymelaeoideae). Esta especie se diferencia de las otras dos especies *O. andina* (Poeppig & Endlicher) Meisner and *O. pillopillo* (Gay) Meisner, por varias características vegetativas y florales, entre estas la mas obvia es el indumento seríceo en ambas caras de las hojas y en cara abaxial del hipantio. Con la descripción de *O. sericea* se extiende ampliamente la distribución de *Ovidia* Meisner, la cual se pensaba que era endémica de Chile central y la región adyacente en los andes argentinos. Se presenta también una clave de las especies de *Ovidia*, en el sentido del género como lo definió Nevling.

Key words: Bolivia, Daphneae, *Ovidia*, Thymelaeaceae, Thymelaeoideae.

Meissner (1857) based the genus *Ovidia* on four species, two of which were transferred from *Daphne* L. (*D. andina* Poeppig & Endlicher and *D. pillopillo* Gay), while the other two were new species (*O. parviflora* Meisner and *O. humboldtii* Meisner [= *Daphne anomala* Kunth]). Later, Gilg (1894) transferred *Daphne anomala* to *Ovidia* in his revision of the Thymelaeaceae, but Domke (1934) disagreed with the addition and subsequently transferred the species to *Daphnopsis* Martius.

In a generic revision of *Ovidia*, Nevling (1964) accepted two species, *O. andina* and *O. pillopillo*, and reduced the other names to synonymy. Some authors (Hernández, 1964, 1988; Zuloaga & Morrone, 1999) have not considered *O. andina* and *O. pillopillo* to be distinct species, but others (Schick, 1980; Hoffmann, 1994) have recognized both species. Regardless of the disagreement, both taxa can be distinguished by a few morphological differences and their non-overlapping geographic distributions.

The persistent leaves of *Ovidia andina* are crowded near branch tips and the blades are covered with a sparse uniform strigose indument; the leaves of *Ovidia pillopillo* are spaced evenly along stems and the blades are glabrous or strigose apically. In *Ovidia andina* the inflorescences are not subtended by leaves and are borne on 6–21 mm long peduncles, whereas the inflorescences of *Ovidia pillopillo* are subtended by 2 to 5 leaves and

are borne on 1–7 mm long peduncles. *Ovidia andina* occurs from 700 to 2300 m elevation in central Chile and along the adjacent Andean slopes of Argentina; *O. pillopillo* is confined to central Chile from 50 to 700 m elevation (Nevling, 1964).

The description of *Ovidia sericea* Antezana & Z. S. Rogers, a species collected for the first time in 1957 and apparently endemic to central Andean Bolivia, marks the first occurrence of the genus outside of Chile and Argentina, effectively extending the distribution of the genus by perhaps as much as 2000 km to the north of known populations of *O. andina* and *O. pillopillo*.

The new species has a distinctive morphology, with the most obvious character being the dense sericeous indument on both leaf surfaces. All other species of Thymelaeaceae occurring in the Americas do not have persistent indument on the adaxial surface of the leaf. Furthermore, the indument on the abaxial leaf surface of most species of Thymelaeaceae is rarely persistent. In the Old World, some species with leaves that remain adaxially adpressed to the stems often have a dense sericeous indument on the adaxial leaf surface (e.g., *Thymelaea hirsuta* (L.) Endlicher [= *Passerina hirsuta* L.], Mediterranean Region), while others without adpressed leaves rarely have a dense persistent indument on both the adaxial and abaxial leaf surfaces (cf. *Gnidia anomala* Meisner, Africa).

Full exsiccatae citation and images of type material of *Ovidia sericea* are available through the Missouri Botanical Garden w³ TROPICOS website at the following address: ⟨http://mobot.mobot.org/W3T/Search/vast.html/⟩.

KEY TO THE SPECIES OF *OVIDIA* IN SOUTH AMERICA

1a. Leaf surfaces densely sericeous on both sides; venation inconspicuous; hypanthia cylindrical, 8–12 mm long, strigose adaxially, densely sericeous abaxially; plants of Bolivia . . . . . *O. sericea*

1b. Leaf surfaces glabrescent, or sparsely strigose abaxially; venation conspicuous; hypanthia urceolate-campanulate, 2–5 mm long, glabrous adaxially, glabrous or strigose abaxially; plants of Chile and Argentina.

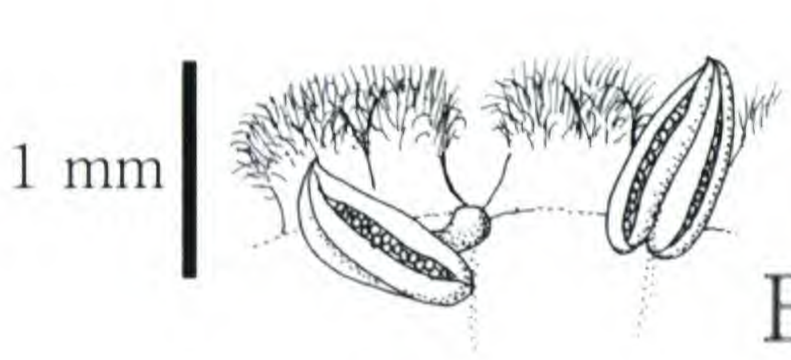
2a. Persistent leaves crowded near branch tips; abaxial leaf surfaces covered with a sparse uniform strigose indument; inflorescences not subtended by leaves; peduncles 6–21 mm long; 700–2300 m elevation; plants of Chile and Argentina . . . . . *O. andina*

2b. Persistent leaves evenly distributed along stems; abaxial leaf surfaces glabrous, or strigose only at apex; inflorescences subtended by 2 to 5 leaves; peduncles 1–7 mm long; 50–700 m elevation; plants of Chile . . . . . *O. pillopillo*

Ovidia sericea Antezana & Z. S. Rogers, sp. nov. TYPE: Bolivia. Chuquisaca: Oropeza, Cerro Chataquila, by track along ridge heading N from El Santuario, 3730 m, 18°58′S, 65°24′W, 7 Oct. 2003 (fl), *J. R. I. Wood, A. Carretero & J. Gutierrez 19716* (holotype, MO; isotypes, BOLV, HSB, K, LPB, MO, NY, USZ). Figure 1.

In inflorescentia umbelliforme *Ovidia andinam* et *O. pillopillo* simulans, sed in plantis indumento dense sericeo praeditis, foliis subverticillatis (haud dissitis qua in speciebus aliis) laminis venatione haud conspicua (conspicua), et hypanthiis cylindricis 8–12 mm longis (2–5 mm longis) intus strigosis (haud glabris), differt.

Multi-stemmed evergreen gynodioecious shrubs, 1–5 m tall, branching pseudo-dichotomous, bark dark gray externally, leaf scars semicircular, bark light yellow internally, young stems densely sericeous. Leaves spirally arranged, subverticillate, sessile or subsessile, with articulated petioles, caducous on older stems; blades obovate to elliptic, 1.1–4.5 × 0.4–1.1 cm, length/width ratio 1.6–4.1: 1, gray-green, caducous, covered with dense sericeous indument on both surfaces, trichomes sometimes shorter and less dense on adaxial surface, trichomes 0.7–1.6 mm long, unicellular, unbranched, silver; midrib nearly inconspicuous adaxially, slightly raised and conspicuous abaxially, venation inconspicuous on both surfaces, apex acute or apiculate, margin slightly revolute, base cuneate or decurrent. Inflorescences terminal, sometimes false axillary, umbellate, 9 to 17 flowers per inflorescence; peduncles 8–20 mm long, densely sericeous; inflorescence bract 1, borne on inflorescence axis just below flowers, identical to the leaves but caducous, 4.5–16 × 1.8–3.3 mm. Flowers bisexual or pistillate (with 8 inconspicuous staminodes), 4-merous; pedicels 2–8 mm long, densely sericeous; hypanthia cylindrical, 8–12 × 1.5–2.5 mm, covered with dense sericeous indument abaxially, denser near base, moderately strigose and yellow adaxially, articulation absent; calyx lobes 4, spreading, one pair slightly longer, ovate, 2–4 × 1–2 mm, sparsely sericeous adaxially, densely sericeous abaxially, apex acuminate; petals reduced to 8 fleshy scales, scales alternisepalous, adnate just below tube opening, rectangular, 0.4–1.1 × 0.6–1.1 mm, bifid, notched or nearly divided to base, apex rounded, densely to moderately sericeous; stamens 8, diplostemonous, introrse, filaments fused to the inner wall of tube, upper whorl at height of scales, adnate just below mouth, lower whorl adnate 0.5–1 mm below mouth, anthers oblong to slightly obcordate, 0.7–1.3 × 0.4–0.8 mm, ± basifixed, subsessile; extragynoecial disk absent or inconspicuous, composed of ca. 8 thin membra-



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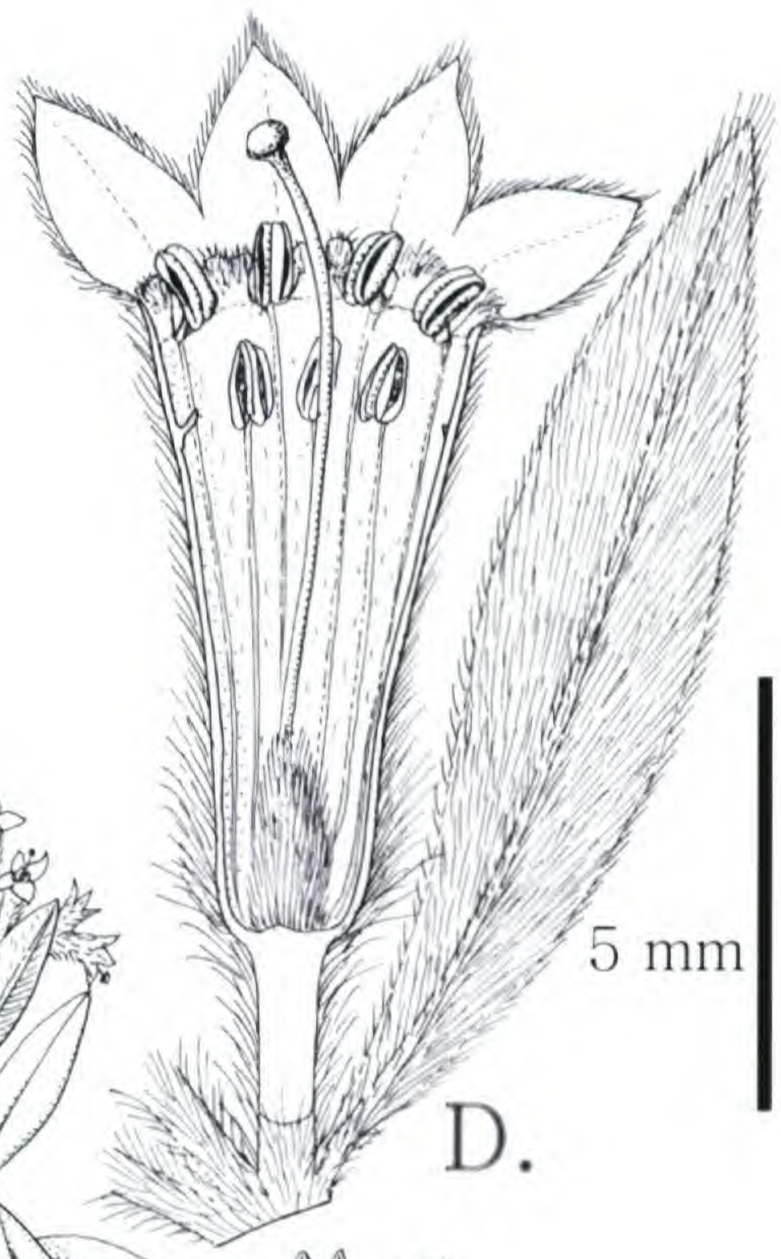

D.

A.

C.

B.

Rosemary Wise

Figure 1. *Ovidia sericea* Antezana & Z. S. Rogers. —A. Habit. —B. Abaxial leaf surface. —C. Abaxial leaf surface (trichomes removed from blade surface). —D. Flower, longitudinal section, with a single foliaceous inflorescence bract subtending the flowering portion of the peduncle. —E. Detail of hypanthium scales and anthers. All parts drawn from *J. R. I. Wood 9047* (K).

nous segments, segments rectangular, 0.1–0.2 × 0.3–0.4 mm, glabrous; gynoecium sessile or subsessile, ovary superior, unilocular, ovoid to oblong, 1.5–5.0 × 0.9–2.5 mm, sericeous, trichomes longer near apex, with 2 conspicuous longitudinal sutures, one suture continuous with the style, style lateral, filiform, 4.1–11 mm long, glabrous, stigma capitate, exserted. Fruits not seen.

Distribution and phenology. *Ovidia sericea* grows in central Andean Bolivia in the Chuquisaca, Cochabamba, and Potosí departments from 2900 to 3730 m elevation. It is locally abundant on exposed, scrubby ridges and hill slopes, where it sometimes forms open communities, although it more frequently occurs sporadically. It is apparently restricted to sandstone outcrops in areas of transition to "puno" type vegetation. *Ovidia sericea* is usually not accompanied by other shrubs or trees, although various cacti, such as *Sulcorebutia steinbachii* (Werdermann) Backeberg and *Lobivia pentlandii* (Hooker) Britton & Rose, or other ground flora, such as *Puya* spp. or *Plazia daphnoides* Weddell, may be associated. *Ovidia sericea* is unusual among woody plants from the drier central regions of Bolivia in being evergreen. It flowers principally from August to December, but individuals can be found flowering sporadically at any season.

Local names reported for *Ovidia sericea* include *Roble* (Chataquila area), *Sila Sila* (Ravelo area), and *Toma* (Toro-Toro area). As is the case with many other Thymelaeaceae, the species is reputed to be poisonous and is shunned by grazing animals.

Ovidia sericea most obviously differs from *O. andina* and *O. pillopillo* by its dense sericeous indument covering its leaves and other vegetative parts. There is, however, some variation in the density of the leaf indument in some populations; in the majority of collections, the indument on the adaxial leaf surface is less persistent, which allows the green color of the leaf and midrib to show through, whereas in other collections (*O. Murgia 151, J. R. I. Wood 7623, J. R. I. Wood & M. Serrano 14393, ZONISIG 355*) the indument is so dense and persistent that both leaf surfaces are grayish green, and the venation and blade surface are inconspicuous.

This new species also differs from the two other species of *Ovidia* by its longer, cylindrical hypanthia (8–12 mm long) that are covered with a dense sericeous indument abaxially and strigose indument adaxially, by its shorter stem internodes, and by its foliaceous bract that is adnate to the peduncle just below the flowers. In contrast, *Ovidia andina* and *O. pillopillo* are glabrous or have a sparsely strigose indument on the abaxial surface of their leaves, urceolate-campanulate hypanthia (2–5 mm long) that are glabrescent or sparsely strigose abaxially and glabrous adaxially, and longer stem internodes than those found in *O. sericea.*

Meissner (1857) described the inflorescences of *Ovidia* as ebracteate, and Nevling (1964) did not mention bracts throughout his revision. In fact, we have been unable to find any mention of inflorescence bracts in *Ovidia* in the literature, nor have we seen any bracts on the specimens of *O. andina* or *O. pillopillo* that we have examined. Based on the primary author's observations, *Ovidia andina* lacks bracts on the inflorescence axis altogether, *O. pillopillo* has 2 to 5 leaves adnate just below the inflorescence axis that subtend very short peduncles. In *O. sericea,* however, a distinct leafy bract is present on the peduncle immediately below flowers.

A curious feature of *Ovidia sericea* in all 22 collections enumerated below is the absence of mature fruit. It is not known under what conditions fruit is successfully produced, but no seedlings or young plants have been observed in the field.

Paratypes. BOLIVIA. **Chuquisaca:** Oropeza, ca. 30 km toward Ravelo, zona de Cajamarca, *S. Beck 8830* (BAB, LPB); Chataquila, *O. Muñoz 151* (HSB), *O. Murgia 151* (LPB), *O. Murgia 381* (LPB); Oropeza, Chataquila betw. Punilla and Chaunaca, *J. R. I. Wood 7623* (K, LPB); Oropeza, Cerro Obispo, betw. Sucre and Quila Quila, *J. R. I. Wood & M. Serrano 14393* (K, LPB, MO). **Chuquisaca/Potosí:** Oropeza/Chayanta, Milluni, *G. Muehlbauer 35* (BAB, LPB). **Cochabamba:** Mizque, camino de Rakaypampa hacia Lagunas, *E. Saravia & A. Lopez 858* (BOLV); Desvio de Kuri Khasa a Molinero, *C. Antezana 958* (BOLV); Camino hacia Lagunas, ladera de exposición O, *C. Antezana 704* (BOLV). **Potosí:** Charcas, Toro-Toro a 4 hrs. de caminata del pueblo hacia el W, *G. Torrico & C. Peca 525* (BAB, BOLV, LPB); 12.5 km SE of Toro-Toro, *Proyecto ZONISIG 355* (LPB); Toro-Toro, quebrada Mula Wacana en el Cerro Manka Paki, *J. R. I. Wood, M. Atahuachi & M. Mercado 19249* (BOLV, K, LPB); Chayanta, Ravelo, *Cañigueral 912* (LPB); Safiri, camino Sucre–Ravelo, *G. Muehlbauer s.n.* (LPB); 12 km from Ravelo towards Oruro, *S. Beck & M. Liberman 9340* (BAB, LPB); 7 km from Ravelo on road from Sucre, *S. Beck 21181* (BAB, LPB); 5 km W of Ravelo, *M. Kessler 3272* (GOET, LPB); 96 km S of Moroto, *Proyecto ZONISIG 366* (LPB); 1–2 km E of Safiri along road from Ravelo to Sucre, *J. R. I. Wood 18898* (HSB, K, LPB); Cornelio Saavedra, Chorillos near Betanzos, *R. Lopez, V. Markgraf & R. C. Paz 431* (LPB); in the valley NW of Ticoya, Betanzos area, *J. R. I. Wood 9047* (K, LPB).

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Dicranopygium callithrix (Cyclanthaceae), a New Species from the Cauca Valley, Colombia

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ABSTRACT. *Dicranopygium callithrix*, a new species of Cyclanthaceae, is described from the northern end of the Cauca Valley in western Colombia. It belongs to subgenus *Dicranopygium*, section *Dicranopygium*. Its very long white staminodes, combined with other floral and foliar characters, distinguish it from all other described species of this genus. *Dicranopygium callithrix* is the only species of *Dicranopygium* known from the Cauca Valley and may be endemic there. It is in danger of extinction.

RESUMEN. *Dicranopygium callithrix*, una nueva especie de Cyclanthaceae, se describe, procedente del extremo septentrional del valle geográfico del río Cauca, en la parte occidental de Colombia. La nueva especie pertenece al subgénero *Dicranopygium*, sección *Dicranopygium*. Sus estaminodios blancos y muy largos, combinados con otros caracteres florales y foliares, la distinguen de todas las otras especies descritas de este género. *Dicranopygium callithrix* es la única especie de *Dicranopygium* que se conoce del valle geográfico del río Cauca, y es posible que sea endémica allí. Está en peligro de extinción.

Key words: Cauca Valley, Colombia, Cyclanthaceae, *Dicranopygium*.

The genus *Dicranopygium* Harling comprises about 50 known species, distributed from Mexico to Suriname, Peru, and Brazil (Harling & Eriksson, 1998). These plants usually grow adjacent to or in small streams within forest; most species are found in lowlands. Harling (1958) noted that the pollinators of *Dicranopygium* probably are weevils (Coleoptera: Curculionidae) and that the seeds may be dispersed by water.

Dicranopygium is the second largest genus in the family Cyclanthaceae and probably includes several undescribed species. The species described here was discovered during a floristic inventory for the checklist of the relictual forest flora of the Cauca Valley.

Dicranopygium callithrix Silverstone-Sopkin, sp. nov. TYPE: Colombia. Risaralda: Mun. Pereira, Hacienda Alejandría, km 7 Cerritos–La Virginia road, N end of Cauca Valley, low hills, ca. 950–960 m, 4°51′27″N, 75°52′49″W, 12 Nov. 2001, *P. A. Silverstone-Sopkin, N. Paz, H. Sanint et al. 8813* (holotype, CUVC #33394 [leaf], *33395* [inflorescence] [see Greuter et al., 2000: Art.8.3 ex. 4]; isotype, COL). Figure 1.

A sex speciebus aliis generis *Dicranopygii* quae staminodia longa habent combinatione sequenti characterum distinguitur: longitudine petiolorum et foliorum, latitudine segmentorum foliorum, profunditate sinus foliorum, foliis unicostatis, receptaculo florum masculinorum plano, longitudine filamentorum et antherarum, tepalis florum femineorum sine glandibus, spathis et staminodiis albis.

Terrestrial herbs, lacking aerial stem or with short prostrate aerial stem. Leaf blades unicostate, (48–)71–104 cm long, bifid (34–)41–51(–65)% of their length, base unequal, cuneate, segments 4.5–12.7 cm wide at base of sinus, lanceolate, tips attenuate to acuminate; petiole (25–)50–109(–133) cm long. Peduncle during anthesis 13–27 cm long, in fruiting stage 20.5–50 cm long; spathes 3 or 4, white and concave on adaxial surface, green on abaxial surface, caducous; lowermost (outermost) spathe 5.4–10 cm long, 2.3–2.4 cm wide at base, long-triangular, attenuate to acuminate; upper (inner) spathes 3.6–7.2 × 1.8–4.5 cm, ovate to lanceolate, acuminate to acute; spadix cylindrical, during anthesis 2–3 × 1–1.6 cm, in immature fruiting stage 2.5–6 × 1–2.3 cm. Staminate flowers pedicellate, seen from above 2.3–4.5 mm median width, 1.8–3 mm lateral width, trapezoidal; receptacle 1.8–2 mm wide, flattened above; perianth lobes 5 to 7, present only on one side of flower, 1 × 0.6 mm, oblong, tip acute to obtuse, glanduliferous; stamens white, 24 to 35 per flower; anthers 0.8 × 0.7 mm, connective narrow, thecae not divergent, filaments ca. 0.2 mm long, basal bulbs ca. 0.5–0.7 × 0.5 mm, oblong, somewhat flattened on abaxial and adaxial surfaces. Pistillate flowers seen from above during anthesis 3.5 mm median width, 3.5 mm lateral width, in immature fruiting stage to 7–9.5 mm median width, 7–9.5 mm lateral width;

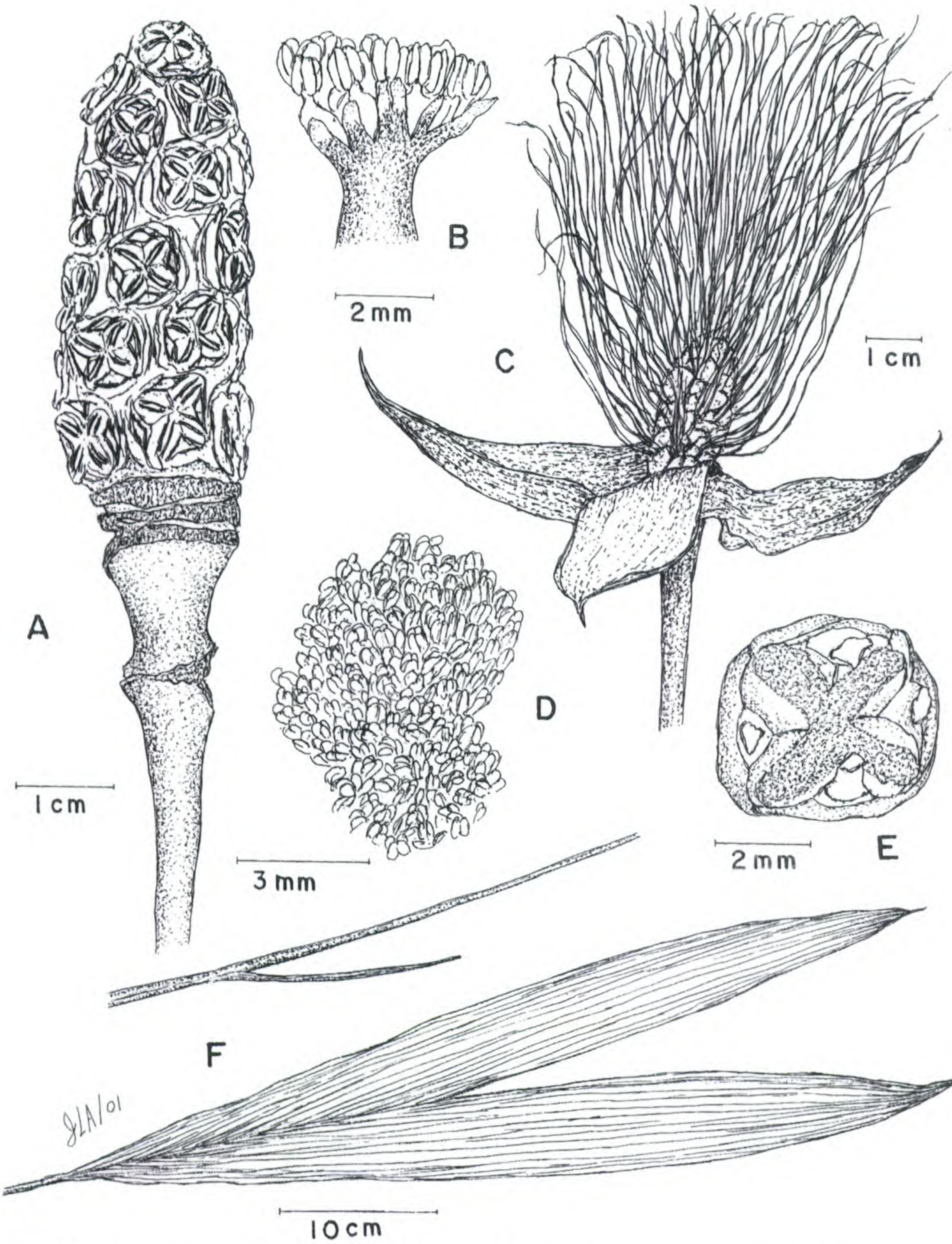

Figure 1. *Dicranopygium callithrix* Silverstone-Sopkin. —A. Immature infructescence, including upper part of peduncle with four spathe scars. —B. Staminate flower (lateral view). —C. Inflorescence at anthesis with staminodes. —D. Group of three staminate flowers (seen from above). —E. Pistillate flower (seen from above), showing tepals, stigmas, and staminode scars. —F. Petiole (with sheath) and leaf blade. Based on the holotype, *P. A. Silverstone-Sopkin, N. Paz, H. Sanint et al. 8813* (CUVC).

tepals during anthesis ca. 0.8 mm long, 2.5–3 mm wide, in immature fruiting stage ca. 1.5 mm long, 4–8.5 mm wide, tip truncate, not glanduliferous; stigmas sessile, slightly convex, not laterally compressed, ellipsoid to suborbicular seen from above, tips rounded, not projecting between tepals; staminodes white, 6–10.8 cm long. Mature fruits and seeds not seen. (Floral measurements were made from material preserved in 70% ethanol and 5% glycerin; other measurements were made from dried material.)

I observed that the inflorescence emitted a strong, pleasant odor at anthesis; the flowers were visited by small curculionid beetles. Flowers of Cyclanthaceae are generally protogynous (Harling, 1958). The type material was collected at the pistillate phase; thus anther dehiscence was not observed, but is expected to be latrorse (as in all species of section *Dicranopygium*).

Etymology. From the Greek, *calli-*, beautiful, and *thrix*, hair, referring to the long, white, showy staminodes. The specific epithet is a noun in apposition (Greuter et al., 2000: Art. 23.5).

Distribution and habitat. Dicranopygium callithrix is known only from the extreme northern end of the Cauca Valley, near the town of La Virginia, at the Hacienda Alejandría and the adjacent Hacienda Córcega, 950–970 m. It was probably more widespread in the past, but the almost total destruction of forests in the Cauca Valley has eliminated most of the suitable habitats. I have not found it in any of the few other small patches of forest that remain in the Cauca Valley, but it might still occur in forest patches in the piedmont of the western slope of the Cordillera Central.

In the Holdridge system, the plant formation at the type locality is tropical dry forest (mean annual precipitation at the adjacent Hacienda La Bohemia is 1764 mm), but the microclimate at the collection site (within the gallery forest) certainly is more humid; the epiphytic melastome *Blakea* and the arborescent fern *Cyathea* are found here (and nowhere else in the Cauca Valley).

The habitat at the type locality and at the Hacienda Córcega is an "artificial" gallery forest, bordering a creek. This whole region was formerly forested, but most of the forest was cut, beginning in 1915, to create pasture for cattle-raising (Hilda Sanint, pers. comm.). The forest along these creeks was spared because the steep slopes along the banks were not suitable for cattle. These creeks are shallow, narrow, and slow-flowing, with many rocks. Individuals of *D. callithrix* are found only on the edges of and within the creeks, shaded by the gallery forest. This is the typical habitat of the genus *Dicranopygium*.

Discussion. Dicranopygium callithrix belongs to subgenus *Dicranopygium*, section *Dicranopygium*; this is indicated by its unicostate leaves, staminate flowers with unilateral glandular perianth lobes and flattened receptacle, relatively short anthers with a narrow connective and parallel thecae, and pistillate flowers with broad (not compressed and aliform) stigmas.

Dicranopygium callithrix is unusual in its long, showy staminodes, much longer than those of most species of the genus (staminode length is not known in some species). Only six known species of *Dicranopygium* approach *D. callithrix* in staminode length (6 cm or more); three of these are known only from the Amazonian lowlands (one from Colombia and two from Ecuador). One of these, *D. lugonis* Harling, belongs to another section, *Adenotepalum*, characterized by tricostate leaves and glanduliferous tepals in the pistillate flowers, features lacking in *D. callithrix*. The other two, *D. aurantiacum* (R. E. Schultes) Harling and *D. coma-pyrrhae* (Harling) Harling, have bright yellow or red-orange staminodes, and the latter has yellow to yellow-red spathes, whereas the staminodes and spathes are white in *D. callithrix*. *Dicranopygium aurantiacum* also differs from *D. callithrix* in its much narrower (0.6 cm wide) leaf segments and much more deeply bifid leaves (to 83%), and *D. coma-pyrrhae* differs in its longer stamen filaments (0.3–0.4 mm long).

Dicranopygium fissile Galeano & Bernal was described from the piedmont (1100 m) of the eastern side of the Cordillera Central in Colombia. It resembles *D. callithrix*, but petioles are 44–50 cm long in *D. fissile*, (25–)50–109(–133) cm long in *D. callithrix*; leaf blades are 47–55 cm long in *D. fissile*, (48–)71–104 cm long in *D. callithrix*; anthers are 0.9–1.3 mm long in *D. fissile*, 0.8 mm long in *D. callithrix*; filaments are 0.3–0.5 mm long in *D. fissile*, ca. 0.2 mm long in *D. callithrix*; staminodes are 6 cm long in *D. fissile*, 6–10.8 cm long in *D. callithrix*.

Dicranopygium arusisense Tuberquia and *D. odoratum* Tuberquia are known only from the Pacific coast of Colombia; their staminodes are longer (12 cm) than those of *D. callithrix*. *Dicranopygium callithrix* differs from both species in having longer petioles ([25–]50–109[–133] cm vs. 10–26 cm in *D. arusisense* and 22–35 cm in *D. odoratum*), shorter anthers (0.8 mm vs. 1–1.5 mm in *D. arusisense* and 1.3–1.6 mm in *D. odoratum*), and white staminodes (red in *D. arusisense*, yellow in *D. odoratum*). In addition, *D. callithrix* differs from *D. aru-*

sisense in the flat upper surface of the receptacle of the male flowers (deeply sunken in *D. arusisense*) and in its parallel anther thecae (divergent in *D. arusisense*); *D. callithrix* also differs from *D. odoratum* in its white spathes (purple-red in *D. odoratum*).

Dicranopygium callithrix resembles (and in Harling [1958, 1973] keys out to) *D. calimense* Harling, *D. grandifolium* Harling, and *D. rheithrophilum* (Harling) Harling; all three species are found west of the Andes in Colombia and Ecuador, and *D. grandifolium* also is found in Venezuela. The leaves of *D. callithrix* are bifid from one-third to two-thirds of their length. This range of variation encompasses that of all three similar species, but the leaf blades and petioles of *D. callithrix* are much longer than those of *D. calimense* and *D. rheithrophilum* (*D. calimense*: leaf blades and petioles each 35–40 cm, *D. rheithrophilum*: leaf blades 15–35 cm, petioles to 30 cm). The leaf blades and petioles of *D. grandifolium* are longer than those of the other two species, and the range of variation (leaf blades and petioles each 35–75 cm long) overlaps that of *D. callithrix*. *Dicranopygium callithrix*, however, has staminate flowers with more numerous perianth lobes (5 to 7) than *D. calimense* (4 to 5) and *D. grandifolium* (3 to 5), and differs from all three species in its numerous stamens (24 to 35) and much longer staminodes (6–10.8 cm); in *D. calimense*, *D. grandifolium*, and *D. rheithrophilum* stamen number is 9 to 16, 12 to 18, and 15 to 25, and staminode length is 3–4 cm, 2.5–3 cm, and 2–3 cm, respectively.

There is no doubt as to the subgeneric and sectional placement of *Dicranopygium callithrix*. Its relationships to the other species of the section *Dicranopygium* are unknown (as is the case with many species of this section), and its resemblance in certain morphological characters to the species mentioned above does not necessarily indicate a close relationship.

It should also be noted that, apart from the widespread bird-dispersed species *Carludovica palmata* Ruiz & Pavón, *D. callithrix* is the only species of Cyclanthaceae that my colleague Jorge E. Ramos-Pérez and I have encountered in the Cauca Valley during 17 years of fieldwork here. If Harling's (1958) hypothesis that *Dicranopygium* is dispersed by water in streams is correct, then it is not surprising that Chocoan and Amazonian species of this genus are not found in the Cauca Valley, and it is quite likely that *D. callithrix* is endemic to the Cauca Valley and perhaps part of the adjacent piedmont of the Central Cordillera. Without doubt, it is a species in danger of extinction. It could be categorized tentatively as EN (endangered) (Calderón et al., 2002).

Paratypes. COLOMBIA. **Risaralda:** Mun. Pereira, Hacienda Córcega, 18 km by road from La Virginia, 7 km W of Cerritos–La Virginia road, N end of Cauca Valley, ca. 4°50′N, 75°53′W, 28 Nov. 1989, *P. A. Silverstone-Sopkin, J. E. Giraldo-Gensini & H. M. Cabrera-Arana 5754* (CUVC, FMB, JAUM, MO), 30 Dec. 1994, *P. A. Silverstone-Sopkin & N. Paz 7244* (COL, CUVC); Hacienda Alejandría, km 7 Cerritos–La Virginia road, N end of Cauca Valley, 4°51′27″N, 75°52′49″W, 6 July 1995, *P. A. Silverstone-Sopkin & H. Berrío-Baca 7714* (CTES, CUVC, HUA, TULV), 26 Jan. 1997, *P. A. Silverstone-Sopkin, N. Paz et al. 7831* (CUVC).

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Festuca dinirica and *F. guaramacalana* (Poaceae, Loliinae), Two New Species from the Venezuelan Andes

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ABSTRACT. Two new species, *Festuca dinirica* Stančík and *F. guaramacalana* Stančík (Poaceae, Loliinae), from the Venezuelan Andes are described. *Festuca dinirica* is found in the páramo zone and seems best placed in subgenus *Festuca* sect. *Aulaxyper*; *Festuca guaramacalana* is found in humid mountain forests and belongs in *Festuca* subg. *Subulatae* sect. *Subulatae*. Both species are endemic to Venezuela, known from small areas of Dinira National Park and Guaramacal National Park, respectively.

RESUMEN. Se presentan dos especies nuevas, *Festuca dinirica* Stančík and *F. guaramacalana* Stančík (Poaceae, Loliinae), endémicas de los Andes de Venezuela. La especie *F. dinirica* pertenece al subg. *Festuca* sect. *Aulaxyper* y se conoce solo de la zona paramúna del Parque Nacional Dinira. La especie *F. guaramacalana* es un representante del subg. *Subulatae* sect. *Subulatae*, endémica de la zona del bosque húmedo altoandino del Parque Nacional Guaramacal.

Key words: Andes, endemic, *Festuca*, Loliinae, Poaceae, Venezuela.

The genus *Festuca* L. is a highly diversified cosmopolitan grass genus, represented by over 140 species (Darbyshire et al., 2003) in the Andes of South America and one extra-Andean enclave in southeastern Brazil and northeastern Argentina.

Revision of *Festuca* in Venezuela has resulted in recognition of two new species, *Festuca dinirica* and *F. guaramacalana*. Type collections of these new species come from recently organized field studies in little known regions of Dinira National Park (State Lara) and Guaramacal National Park (State Trujillo), and represent first collections of *Festuca* from these areas (for comparison, see Alexeev, 1986; Briceño & Morillo, 1994; Dorr et al., 2000; Vareschi, 1970). Both species appear to be endemic to the Venezuelan Andes.

Festuca dinirica belongs in subgenus *Festuca* L. sect. *Aulaxyper* Dumort. This section is represented by only a few (probably 2 to 4) species in South America and remains insufficiently known. The geographically nearest species with clear affinity to section *Aulaxyper* is the markedly distinct species *Festuca andicola* Kunth from swampy habitats in Colombia and Ecuador.

Festuca guaramacalana belongs in subgenus *Subulatae* (Tzvelev) E. Alexeev sect. *Subulatae* Tzvelev represented in Venezuela by two other species (*F. ulochaeta* Nees ex Steudel and *F. coromotensis* Briceño). An artificial key for distinguishing these species is provided. The survey of known South American members of *Festuca* sect. *Subulatae* was published recently (Stančík & Peterson, 2002) and included eight species.

Festuca dinirica Stančík, sp. nov. TYPE: Venezuela. Lara: Munic. Humocaro Alto. NP Dinira, 09°35′38.7″N, 70°07′12.2″W, 3170 m, 30 Nov. 2000, *Stančík 4287* (holotype, PRC; isotypes, CAR, COL). Figure 1f–j.

Haec species a *Festuca tolucensi* innovationibus mixtis non intravaginalibus, ligula foliari 0.5 (non 1.8–3.5) mm longa, foliis tenuioribus 0.3–0.5 (non 0.5–0.7) mm latis, glabris (non scabris), sclerenchymate abaxiali cum fasciculis vascularibus non junctis differt.

Tussocks, 50–60 cm tall; innovations mixed; *culms* erect, glabrous, with 1 to 3 nodes in basal half. *Sheaths* coriaceous-membranous, brownish gray, glabrous, fibrous; *ligule* 0.5 mm long, shortly ciliate; *leaf blades* linear, 20–30 cm long, 0.3–0.5 mm wide, involute, pungent, glabrous, green. *Panicle* contracted, lanceolate, 6–10 cm long and 0.7–1 cm wide; branches scabrous. *Spikelets* 8–10 mm long, lanceolate, with 3 to 4 perfect florets; rachilla scabrous or sparsely covered by hairs; *glumes* membranous, upper ⅓ scabrid; lower glume 3.5–4.2 mm long, lanceolate, acute, 1-nerved; upper glume 6–7 mm long, lanceolate, acute, 3-nerved; *lemmas* 6–7 mm long, 5-nerved, membranous, lanceolate, scabrous, awned; *awn* 1–3 mm long; callus glabrous; *palea* membranous, 2-carinate, scabrous, markedly 2-dentate, as long as lemma; lodicules lanceolate, 2-dentate; *stamens* 3, anthers 2–2.5 mm

Figure 1. a–e, *Festuca guaramacalana* Stančík (*Stančík 4286*, PRC). —a. Habit (bar: 9 cm). —b. Fragment of panicle (bar: 32 mm). —c. Spikelet (bar: 14 mm). —d. Glumes (bar: 7 mm). —e. Cross section of leaf (bar: 0.4 mm). f–j, *Festuca dinirica* Stančík (*Stančík 4287*, PRC). —f. Habit (bar: 5 cm). —g. Panicle (bar: 2.5 cm). —h. Spikelet (bar: 10 mm). —i. Glumes (bar: 9 mm). —j. Cross section of leaf (bar: 0.3 mm).

long; ovary apex glabrous. *Caryopsis* lanceolate; hilum linear, ⅗–⅘ of total. *Leaf blade section* with 5 vascular bundles and 3 to 5 ribs above; sclerenchyma under abaxial and adaxial epidermis discontinuous, vascular bundles free; adaxial epidermis with microhairs about 0.09 mm long.

Observations. Spikelet structure in the new species resembles *Festuca tolucensis*, another frequent species of the Venezuelan páramos. However, *F. dinirica* differs clearly in organization of the tussocks (small, with mixed innovations in contrast to the big tussocks with intravaginal innovations of *F. tolucensis*), in structure of sheaths (brown, striate, and fibrous sheaths in contrast to the stramineous and integrated sheaths), length of the ligule (0.5 mm vs. 1.8–3.5 mm), and in the anatomic structure of the leaves (abaxial sclerenchyma isolated and all vascular bundles free in contrast to the continuous abaxial sclerenchyma and some vascular bundles united with sclerenchyma).

The formation of the mixed innovations and brown, striate sheaths (partly disintegrated into fibers) make *Festuca dinirica* close to section *Aulaxyper*. In South America, this section is not very frequent and only poorly studied. The Colombian and Ecuadorian species *Festuca andicola* is (geographically) the nearest species with clear affinity to section *Aulaxyper*. *Festuca andicola* differs from *F. dinirica* by growing in swampy areas, forming only solitary culms with long rhizomes, and in having distinctive spikelets (lower glume 1.4–1.8 mm long vs. 3.5–4.2 mm; upper glume 2–2.5 mm long vs. 6–7 mm; lemma 5–5.5 mm long vs. 6–7 mm; awn 0.5–0.7 mm long vs. 1–3 mm; anthers 0.8–1.1 mm long vs. 2–2.5 mm).

Distribution and habitat. *Festuca dinirica* is endemic to Venezuela and known only from the type locality—Dinira National Park in Lara. This species forms small tussocks in shrubby-grassy páramos, associated with *Blechnum* L., *Espeletia* Mutis ex Bonpland, *Hypericum* L., *Calamagrostis* Adanson, *Chusquea* Kunth, *Rhynchospora* Vahl, etc., at an altitude of ca. 3200 m. No more information about the distribution of this species is available. It is probably steno-endemic and vulnerable to extinction.

The specific epithet refers to the type locality, Dinira National Park.

Paratypes. VENEZUELA. **Lara:** Humocaro Alto. NP Dinira, 09°35′38.7″N, 70°07′12.2″W, grass páramo with shrubby patches, 3170 m, 30 Nov. 2000, *Stančík 4289* (CAR, COL, PRC), *Stančík 4288* (CAR, COL).

KEY TO THE VENEZUELAN SPECIES *FESTUCA* SECT. *SUBULATAE*

1a. Lemma with awn markedly flexuous, 7–15 mm long . . . . . 1. *F. ulochaeta*
1b. Lemma awnless or with straight awn 0.5–1 mm long 2
  2a. Spikelets 9–11 mm long, with 3 to 4 florets, awn 0–0.5 mm long . . . . . 2. *F. coromotensis*
  2b. Spikelets 15–17 mm long, with 5 to 7 florets, awn 0.5–0.1 mm long . . 3. *F. guaramacalana*

Festuca guaramacalana Stančík, sp. nov. TYPE: Venezuela. Trujillo: Bocono, PN Guaramacal, 09°14′15.1″N, 70°11′14.3″W, 2880 m, 29 Nov. 2000, *Stančík 4286* (holotype, PRC; isotypes, CAR, COL). Figure 1a–e.

Haec species a *Festuca coromotensi* ligula folii acuta non truncata, 1–1.5 (non 0.5–0.7) mm longa, spiculis 15–17 (non 9–11) mm longis, lemmate 9.5–10.5 (non 7.5–8.5) mm longo distinguitur.

Rhizomatous grass, forming small *tussocks*, 100–130 cm tall; innovations extravaginal; *culms* erect, glabrous, with 3 or 4 nodes in distal half. *Sheath* membranous-coriaceous, purplish brown, striate, fibrous at base, margins free; *auricles* absent; *ligule* 1–1.5 mm long, (coriaceous)membranous, acute; *leaf blades* linear, involute, 30–40 cm long and 0.6–0.7 cm wide, (olive-)green, glabrous. *Panicle* branched, flexuous, pendent, elongate, 15–20 cm long and 2–5 cm wide; branches finely scabrous. *Spikelets* narrowly lanceolate, 15–17 mm long, with 5 to 7 perfect florets; rachilla pilose; *glumes* purplish, narrowly lanceolate, acute, coriaceous-membranous, sparsely scabrous; lower glume 3.7–4.7 mm long, 1-nerved; upper glume 5–7 mm long, 3-nerved; *lemmas* coriaceous-membranous, lanceolate, 9.5–10.5 mm long, 5-nerved, purplish, apex entire, papillose, mucronate or shortly awned, the *awn* 0.5–1 mm long; callus sparsely pilose; *palea* two-carinate, finely pilose, almost as long as lemma, apex shortly two-dentate; *lodicules* ovate, two-dentate; *stamens* 3, anthers 2.5–2.8 mm long; *ovary* apex glabrous. *Caryopsis* lanceolate; hilum linear, ⅘ of total length. *Leaf blade cross section* with ca. 11 vascular bundles and 5 ribs above; sclerenchyma under both abaxial and adaxial epidermis discontinuous; unit with some vascular bundles forming girders, bulliform cells absent; adaxial epidermis with scattered microhairs, 0.09 mm long.

Observations. This new species belongs to the section *Subulatae*, and among the South American members of this section *Festuca guaramacalana* has the largest spikelets and longest glumes (Stančík & Peterson, 2002). Similarly, as in the case of *F. sodiroana* Hackel ex E. B. Alexeev and versus

typically long awns elsewhere in section *Subulatae*, the lemma is only shortly awned (0.5–1 mm). Morphologically, *Festuca coromotensis* B. Briceño appears to be the most similar with truncate (vs. acute), shorter ligules (0.5–0.7 mm long vs. 1–1.5 mm), shorter spikelets (9–11 mm long vs. 15–17 mm) with 3 to 4 (vs. 5 to 7) florets, and a shorter lemma (7.5–8.5 mm long vs. 9.5–10.5 mm).

Distribution and habitat. This species is endemic to Venezuela. It is known only from the type collection from the National Park Guaramacal (Trujillo), where it occurs at the margin of a brook with *Neurolepis* Meisner and *Cortaderia* Stapf in Andean mountain forest, at about 3000 m. This species probably occurs rarely, as no additional exemplars were found in the field or in herbarium collections. It is possibly a steno-endemic species vulnerable to extinction.

The specific epithet refers to the type locality region, Guaramacal National Park.

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Sarocalamus, a New Sino-Himalayan Bamboo Genus (Poaceae: Bambusoideae)

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ABSTRACT. *Sarocalamus* Stapleton, a new genus distributed from the eastern Himalayas to the Sichuan Province of China, is described. Among all Asian bamboo genera it shares the greatest number of morphological characters with the North American genus *Arundinaria* Michaux. However, DNA sequencing has suggested that other genera are probably more closely related to *Arundinaria*, while *Sarocalamus* appears instead to be a possible sister group to *Phyllostachys* Siebold & Zuccarini, a genus with some similarities in branching but very different flowers. Biogeographical implications are discussed, and the new combinations *Sarocalamus racemosus* (Munro) Stapleton, *S. faberi* (Rendle) Stapleton, and *S. spanostachyus* (T. P. Yi) Stapleton are made.

Key words: *Arundinaria*, Bhutan, biogeography, China, India, Nepal, North America, *Sarocalamus*.

Characterization of the Asian temperate woody bamboos for the *Flora of Bhutan* (Stapleton, 1994, 2000) and the forthcoming English-language version of the *Flora of China* has established that three species of Sino-Himalayan bamboo are morphologically most similar to the geographically distant type species of *Arundinaria* Michaux, *A. gigantea*, from the southeastern United States (Texas to Maryland). One species, *Arundinaria racemosa* Munro, is from eastern Nepal, the Indian States of West Bengal and Sikkim, and Bhutan. The others, *Arundinaria faberi* Rendle and *Bashania spanostachya* T. P. Yi, are from isolated mountains in southern Sichuan Province, and northeastern Yunnan Province, Southwest China. *Bashania fansipanensis* T. Q. Nguyen from northern Vietnam may also belong in this genus, but is not well known.

Apart from *Sarocalamus*, all other Asian bamboos can be separated clearly from the type species of *Arundinaria* on the basis of floral or vegetative morphological characters. This includes species in the genus *Pleioblastus* Nakai, which is still frequently synonymized within *Arundinaria* but differs in its fused prophyll margins (Stapleton, 1997). Although more than 500 species names have been published in *Arundinaria*, only four, poorly known Asian species do not already have combinations in other genera and a different, modern placement (Ohrnberger, 1999). More than 30 Asian genera have been described by Japanese, Chinese, and European botanists to accommodate species originally described in *Arundinaria*, and the number of genera currently recognized in this group ranges from 19 (Li, 1997) to 28 (Wang, 1997). In a moderate treatment Ohrnberger (1999) included 23 genera. Although the circumscription of *Arundinaria* has remained controversial, with the number of Asian species included in the genus by different authors ranging from 16 (Chao & Chu, 1981) to none (Wang, 1997; Keng & Wang, 1996; Ohrnberger, 1999), it is clear that a large number of temperate Asian genera are now recognized as being distinct from that genus.

Asian bamboos morphologically closest to the North American type species, *Arundinaria gigantea*, such as species of *Sarocalamus*, *Pleioblastus*, and *Bashania* P. C. Keng & T. P. Yi, are often still included in *Arundinaria* (Clayton & Renvoize, 1986; Chao & Renvoize, 1989; Li, 1997). However, molecular evidence from ITS, *trn*L intron, *trn*L-F intergenic spacer, and *rpl*16 intron DNA sequence data (Zhang, 1996; Ní Chonghaile, 2002) has suggested that such species are not necessarily its closest relatives. Instead, *Pseudosasa japonica* (Steudel) Nakai has been suggested as the closest Asian relative of *Arundinaria gigantea* from both *ndh*F and *rpl*16 sequence data (Zhang, 1996; Ní Chonghaile, 2002), a clade comprising *A. gigantea* and *P. japonica* receiving 86% BS (Ní Chonghaile, 2002), even though *P. japonica* has never been con-

sidered a particularly close relative of *A. gigantea* on morphological grounds. *Pseudosasa* Nakai has received almost universal recognition (McClure, 1973; Clayton & Renvoize, 1986; Chao, 1989; Demoly, 1996; Keng & Wang, 1996).

Although *Sarocalamus* shares the principal discreet macro-morphological character states with *Arundinaria*, it still differs in several, more quantitative characters. These include shorter, more cylindrical, more separated and less imbricate florets of more consistent size, less than 10 × 2 mm; a more sinuous rhachilla with much longer internodes; completely glabrous pedicels; and more delicate, smoother, rugose rather than ribbed, less closely spaced leaf blades. The three species of *Sarocalamus* have been placed in four other Asian genera when not included in *Arundinaria*: *Fargesia* Franchet, *Yushania* P. C. Keng, *Bashania*, and *Gelidocalamus* T. H. Wen. *Sarocalamus* differs quite profoundly from *Fargesia* and *Yushania* in having pachymorph rather than leptomorph rhizomes. It is closer to *Bashania* and *Gelidocalamus*. However, while those genera do have leptomorph rhizomes, they also have decurrent, strongly pulvinate synflorescence paraclades, and a much greater degree of compression of the basal internodes on their central branches, giving a higher number of branches at each culm node. *Bashania* also has thickened, prominent, long-ciliate prophyll keels, greater branchlet ramification and tougher leaves, while *Gelidocalamus* has much smaller florets, compressed rhachillas, swollen supra-nodal ridges, solitary, more lanceolate leaves, and its 7 to 12 subequal branches do not re-branch at all.

Molecular evidence is generally lacking at the generic level in Asian woody bamboos, with low or absent support for many well-recognized taxonomic groupings. Combined analyses of data from different genes is starting to provide slightly better resolution, however. What support has been shown at the generic level is generally congruent with morphological distinctions and current taxonomic treatments of Asian bamboos. In the most comprehensive study of woody bamboos (Ní Chonghaile, 2002), one species of *Sarocalamus* was included along with *Arundinaria gigantea*, species of *Bashania*, *Fargesia*, *Yushania*, and 33 other genera. While the two species of *Bashania*, *B. fargesii* (E. G. Camus) P. C. Keng & T. P. Yi and *B. qingchengshanensis* P. C. Keng & T. P. Yi, formed a fairly well-supported clade (70% BS in parsimony analysis, 82% BS in NJ analysis), *Sarocalamus faberi* (included there as *Bashania fangiana* (E. G. Camus) P. C. Keng & T. H. Wen) was not resolved within the *Bashania* clade and did not associate with any other genera in parsimony analysis. It remained a largely unresolved member of the well-supported monophyletic group of mainly Asian temperate bamboos first reported by Watanabe et al. (1994). It is now known to include 25 or more genera from Africa, Asia, and North America adapted to subtropical or temperate habitats in both hemispheres (Ní Chonghaile, 2002), but is widely referred to as the "north temperate clade."

The generic name *Sarocalamus* means broom bamboo and is derived from *saron* (σαρον: broom, sweepings) and *calamus* (καλαμοζ: reed, bamboo). It alludes to the very erect branching, reminiscent of a traditional broom or besom, and the frequent use of these bamboos for sweeping.

Sarocalamus Stapleton, gen. nov. TYPE: *Sarocalamus racemosus* (Munro) Stapleton.

Bashaniae et *Arundinariae* rhizomatibus tenuibus, staminibus 3, inflorescentia ebracteata, gemmis apertis similis, ab illa ramis inflorescentiae erectis, internodiis ramorum longioribus, foliis tenuibus, ab hac flosculis angustis, ab uterque pedicellis glabris, differt.

Similar to *Bashania* and *Arundinaria* in its leptomorph rhizomes, 3 stamens, ebracteate inflorescences and open buds. Differing from the former in its erect inflorescence branches, longer branch internodes and thinner leaves, from the latter in its narrower florets, and from both in its glabrous pedicels.

Temperate self-supporting bamboo; rhizomes leptomorph; culms tillering (pluricaespitose), erect to drooping; internodes smooth, terete; nodes not swollen, unarmed; supra-nodal ridge well developed; branch buds lanceolate, on promontory, enclosed within single, 2-keeled prophylls, always open at the front; branches initially 1 to 3, very erect, appressed, sulcate, basal internodes progressively increasing in length, basal internode often long, lateral branching often distant from culm; complement proliferating to become broom-like, attenuate; lateral branch axes always subtended by sheaths, no replication of lateral branches. Leaf blades linear-lanceolate, thin, less than 12 cm long, with prominent cross-veins (tessellate). Synflorescence initially terminal or lateral to leafy branches, later in leafless complements; synflorescence branches glabrous, without pulvini, remaining very erect and appressed, branching racemose or rarely partially paniculate, not fasciculate, subtended by very small remnants of sheaths or rings of hairs, rarely with very small pulvini. Spikelets 3 to 6 per synflorescence, on glabrous promontory (pedicel); prophyll represented by lower glume; glumes 1 to 2, both small, lower glume usually very small, usu-

ally distant from lower lemma, without subtended buds (flowering semelauctant); rhachilla often sinuous, strongly flattened, more than half length of palea; palea keels curving, appressed to rhachilla; stamens 3; stigmas 3. Flowering gregarious.

Distribution. East Nepal, India (West Bengal & Sikkim), Bhutan, Western China (Tibet, Sichuan and Yunnan Provinces), North Vietnam, 2800–3900 m.

1. **Sarocalamus racemosus** (Munro) Stapleton, comb. nov. Basionym: *Arundinaria racemosa* Munro, Trans. Linn. Soc. London 26: 17. 1868, emend. Gamble in Kew Bull. Misc. Inform. 1912: 138. 1912. *Fargesia racemosa* (Munro) T. P. Yi, J. Bamboo Res. 2(1): 39. 1983. *Yushania racemosa* (Munro) R. B. Majumdar, in S. Karthikeyan et al., Fl. Ind. Enumerat.–Monocot.: 283. 1989. TYPE: Nepal/Sikkim (India). Islumbo Pass [Chiya Banjyang], 13 Oct. 1857, *Thomson s.n.*, Kew distribution number (K 6738) (lectotype, selected by Gamble (1912: 137), K).

Arundinaria racemosa Munro was first described from collections of two species from the eastern Himalayas (Munro, 1868). It was emended by Gamble (1912), who separated the lower altitude collections from 6000 to 9000 ft. in the vicinity of Darjeeling into a new species, *Arundinaria maling*, now known as *Yushania maling* (Gamble) R. B. Majumdar, leaving only the "high-level form," found above 10,000 ft., in *Arundinaria racemosa*. The Munro syntypes were discussed in detail by Gamble (1912: 137) when describing his new species. He stated "it seems quite evident that Thomson's Islumbo Pass flowering specimen is the real type of *A. racemosa*." This can be taken as an effective lectotypification under Article 7.11 of the *St. Louis Code* (Greuter et al., 2000), as a type element was indicated by direct citation including the term "type." Chao and Renvoize (1989) later designated Munro's first syntype, a Thomson collection made in 1857 from 6000 ft. on Birch Hill in Darjeeling, as lectotype of *A. racemosa*. They apparently did not realize that the species had already been lectotypified by Gamble, even though they concurrently lectotypified *A. maling*, in the protologue of which Gamble had made his lectotypification of *A. racemosa*. According to the label of Thomson's Birch Hill collection, the lectotype designated by Chao and Renvoize was a "pale blue" bamboo. Two bamboos from Darjeeling, *A. maling* and the rarer *Himalayacalamus hookerianus* (Munro) Stapleton, both have pale blue culms, while culms of *A. racemosa* are green or yellow. Gamble (1912: 137) had even stated that "Birch Hill is the end of the Darjeeling Ridge . . . and is a very unlikely locality for the high-level *A. racemosa*." However, as Gamble (1912: 137) had also pointed out, Thomson's collection of some other, pale blue bamboo truly from Birch Hill would seem to have become lost, and the Birch Hill label is currently attached to a sheet bearing only a flowering specimen from Islumbo Pass, which bears the correct label as well. It would appear, therefore, that Chao and Renvoize (1989), by simply designating Munro's first syntype as lectotype, may have inadvertently designated a long-lost collection of *A. maling* or *Himalayacalamus hookerianus* from Darjeeling as lectotype of *A. racemosa*, but fortunately there can be no doubt that the earlier lectotypification of Gamble (1912) takes priority. The Islumbo Pass material shows the distinctive branching and synflorescence of *Sarocalamus* and is accepted here as lectotype of *A. racemosa* Munro and type of the genus *Sarocalamus*. It was collected by Thomson in 1857 in woods above the Islumbo Pass, now known in Nepali as *Chiya Banjyang*, on the Singalila Range, which separates East Nepal and Sikkim. The name *Arundinaria racemosa* is still often misapplied to *Arundinaria maling* Gamble in India (Tewari, 1993; Seethalakshmi & Muktesh Kumar, 1998), even though that species has been transferred by the Botanical Survey of India as *Yushania maling* (Gamble) R. B. Majumdar.

Habitat and distribution. *Sarocalamus racemosus* is found at an altitude of 2900–3800 m in the understory of *Abies densa* and mixed coniferous and rhododendron forests, in degraded forest, and in cleared areas of pastureland, in which it can be the principal species. It is often found on more freely drained sites than *Yushania microphylla*, which has hollow rhizomes and extends to a higher altitude. The type collection was made on a pass that constitutes the border between Nepal and Sikkim. Further collections have been made in Sikkim, where it was reported to be common in forests around Senchal (Gamble, 1896), and across western, central, and eastern Bhutan. It is to be expected that it will also be found in further localities in the easternmost districts of Panchtar and Taplejung in Nepal. It has also been reported from Tibet (Yi, 1983) and is to be expected in the Indian State of Arunachal Pradesh.

Additional specimens examined. INDIA. **Sikkim:** Singalila Range, Sukumbum, May 1889, *Dr. Gammie's Collectors s.n.* (K). BHUTAN. **Paro:** Chile La, 4 June 1971, *Bedi 32* (K); Thimphu: Dorchula, 22 Dec. 1989 *Stapleton 872* (THIM). **Tongsa:** Yotong La, 15 Aug. 1989, *Stapleton*

852 (THIM). **Bumthang:** Lame Gompa, 23 June 1990, *Bürgi s.n.* (K, THIM). **Mongar:** Thrumsingla, 11 Oct. 1990, *Wood 7348* (E). **Trashigang:** Tashiyangtse, E side of Pang La, 7 June 2000, *G. & S. Miehe 00-092-03* (THIM).

2. Sarocalamus faberi (Rendle) Stapleton, comb. nov. Basionym: *Arundinaria faberi* Rendle, J. Linn. Soc. 36: 435. 1904. *Sinarundinaria faberi* (Rendle) P. C. Keng, Techn. Bull. Nat. For. Res. Bur. China, No. 8 (Prelim. Stud. Chin. Bamb.): 13. 1948. *Bashania faberi* (Rendle) T. P. Yi, J. Bamboo Res. 12(2): 52. 1993. TYPE: China. Sichuan: above Chungking, Yangtzekiang, *E. Faber 1119* (holotype, K).

Arundinaria racemosa subsp. *fangiana* A. Camus, J. Arnold Arbor. 11: 192. 1930. Basionym: *Sinarundinaria fangiana* (Camus) P. C. Keng, Techn. Bull. Nat. For. Res. Bur. China, No. 8 (Prelim. Stud. Chin. Bamb.): 13. 1948. *Gelidocalamus fangianus* (A. Camus) P. C. Keng & T. H. Wen, J. Bamboo Res. 2(1): 20. 1983. *Bashania fangiana* (A. Camus) P. C. Keng & T. H. Wen, J. Bamboo Res. 4(2): 17. 1985. TYPE: China. Sichuan: Mt. Omei, 15 Aug. 1920, *W. P. Fang 3002* (holotype, P not seen).

Additional material. CHINA. **Sichuan Province:** Omei Shan, 19 July 1925, *Sewell 1* (K); Wolong, Wuyipeng, Nov. 1981, *Halle s.n.* (K); Tiantai Shan, 19 July 1989, *J. P. Ruan 890004* (K). **Yunnan Province:** Dungchuan (living collection 'Tung Chuan No 2' cultivated in Europe & US), Germany, Stockdorf, *Riedelsheimer s.n.* (K); UK, Pulborough, *Addington s.n.* (K).

3. Sarocalamus spanostachyus (T. P. Yi) Stapleton, comb. nov. Basionym: *Bashania spanostachya* T. P. Yi, Acta Bot. Yunnan. 11: 35. 1989. TYPE: China. Sichuan: Huili Xian, Beimu Shan, 3200–3900 m, 18 May 1987, *Yi Tongpei 87249* (holotype, SIFS not seen).

Distribution. Sichuan Province, China.

Discussion

The phylogenetic relationships of *Sarocalamus* remain unclear, although it is evidently a member of the "north temperate clade." Neighbor Joining analysis of combined plastid and nuclear sequence data (Ní Chonghaile, 2002) gave moderate bootstrap support (76%) for a clade comprising *Sarocalamus faberi* (included there as *Bashania fangiana*) and *Phyllostachys flexuosa* (Carrière) A. & C. Rivière, although this clade was not resolved in parsimony analysis. *Sarocalamus* shares simple branching with *Phyllostachys*, but has ebracteate rather than bracteate synflorescences. It also shares other branching characters with *Phyllostachys*, including open, 2-keeled prophylls, presence of a supra-nodal ridge, and substantial sulcation of internodes above the branches. If further investigations support this very tentative placement as sister group to *Phyllostachys*, it could indicate that vegetative characters such as those associated with branching may be at least as phylogenetically informative as a synflorescence type.

As species of *Sarocalamus* share so many discreet morphological character states with the North American species *Arundinaria gigantea*, it is interesting to consider their possible relationships. Ecological and biogeographical considerations would suggest that bamboos endemic to well-drained, high-altitude, cold-temperate forest understory habitats in Sino-Himalayan mountains are unlikely to be congeneric with those found in and around the swamps of the southeastern United States. Their infrequent, cyclical flowering and short-lived seed that is not adapted for dispersal by any agent would appear to lead to limited ability to spread. Cheplick (1998) reported that even grass seed specifically adapted for wind dispersal is rarely carried more than a few meters. Spread of temperate bamboo species probably relies as much on underground extension of rhizomes as on seed dispersal, and it would seem reasonable to expect smaller average natural range sizes for montane bamboos compared to grasses in general. Clark (2001) reported a much higher degree of endemism (87%) in woody Andean bamboos than in other grasses, increasing with altitude, which she considered attributable to isolation among other factors. Bystriakova et al. (2003), studying the distribution of all Asian woody bamboos, reported that 45% have areas of potential occurrence small enough for them to be of conservation concern by IUCN criteria. Several Asian bamboos are quite widely distributed, but those Asian species with the broadest geographic ranges are mainly tropical species of high utility, such as *Bambusa vulgaris* Schrader ex Wendland, suggesting that recent anthropogenic influences could be involved in their distribution patterns.

Unless long-distance dispersal of bamboo seed occurred somehow across East Asia, the Pacific, and North America, it would appear that the ancestors of *Arundinaria gigantea* crossed the Bering Straits land bridge from Asia before the Straits opened, an event dated between 5.4 and 5.5 million years ago (Gladenkov et al., 2002). They would have since become isolated from all Asian relatives such as ancestors of *Sarocalamus*, presumably as a result of a combination of global cooling, rising sea levels, and ice epochs. For such temperate bamboos with flowering cycles of up to a century or more and no seed dispersal mechanism, but lep-

tomorph rhizomes with an annual spreading capability of up to 2 m, it would seem reasonable to expect average sustained migration in any one direction in the order of only 100 m per century. As *Arundinaria gigantea* is currently found about 5–7000 km from the Bering Straits, and only one species of temperate clade bamboo is found on the American continents, this would be consistent with bamboo just entering Alaska before the Straits opened and the land bridge closed. With species of *Sarocalamus* located 6–8000 km to the southwest of the Bering Straits, it could be conjectured that common ancestors of *Arundinaria* and *Sarocalamus* diverged up to twice as long ago, in the order of 10 mya. It would appear from the failure of *Sarocalamus* and *Arundinaria* to be resolved as a separate clade in molecular data produced so far, despite their morphological similarities, that a vicariance event 5–10 mya was sufficiently distant for subsequent evolution to have obscured true relationships, and for the morphological similarities between the genera to be homoplasious or symplesiomorphic.

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Gonolobus incerianus (Apocynaceae, Asclepiadoideae), una Nueva Especie de Mesoamérica

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RESUMEN. Se describe e ilustra una nueva especie endémica de Mesoamérica, *Gonolobus incerianus* (Apocynaceae, Asclepiadoideae).

ABSTRACT. *Gonolobus incerianus* (Apocynaceae, Asclepiadoideae), a Mesoamerican endemic, is described and illustrated.

Key words: Apocynaceae, Asclepiadoideae, *Gonolobus*, Mesoamérica.

El género *Gonolobus* Michaux cuenta con ca. 150 especies distribuidas desde las regiones templadas de Norte América hasta las regiones templadas de Sur América. La mayor diversidad del género se encuentra entre el sur de México y el norte de Mesoamérica. El género se diferencia de los otros géneros en la subtribu Gonolobinae por tener un apéndice extra en la antera, siempre ubicado distalmente en el dorso. Este apéndice es usualmente carnoso, de color distinto al de la antera y más o menos patente o reflejo. Adicionalmente, la corona es siempre un anillo carnoso, simple, entero o 5-lobado, adnado a la corola y el ginostegio, a menudo con un anillo faucial, los lobos de la corola con frecuencia están traslapados y retorcidos cuando en yema, los folículos por lo general tienen 5 alas completas.

La nueva especie aquí descrita se encontró durante la preparación del tratado florístico de Asclepiadaceae para la *Flora de Nicaragua* y la *Flora Mesoamericana.*

Gonolobus incerianus W. D. Stevens & Montiel, sp. nov. TIPO: México. Chiapas: Depto. Amatenango del Valle, slopes 1–1.5 mi. S of Amatenango del Valle, along Hwy. 190, 10 July 1976, *W. D. Stevens, M. J. Donoghue & M. L. Scott 2377* (holótipo, MO). Figuras 1, 2A.

Haec species *Gonolobo leiantho* maxime similis, sed corolla reticulata et lobis calycis angustioribus differt.

Enredaderas, herbáceas o leñosas, sin corcho, con látex blanco, raíces fibrosas; tallos jóvenes con indumento simple o mixto, tricomas largos patentes o reflexos, blancos con septos cafés, densos en los nudos, 0.3–1.1 mm, tricomas glandulares, cuando presentes de 0.07–0.15 mm, entrenudos hasta 21 cm de largo. Hojas opuestas, sin pseudoestípulas, láminas elípticas a ovadas, 5–14.4 × 2.1–7.1 cm, ápice atenuado, base lobada, lobos divergentes a traslapados, seno 0.3–2 cm de profundidad, adpreso-pilosas en la haz con tricomas de 0.2–1 mm, con indumento mixto en el envés, tricomas largos 0.3–0.7 mm, nervios laterales 4 hasta 6 pares, los medios con ángulo de 35–50°, coléteres 2 hasta 4; pecíolo 2.6–7.1 cm, con indumento mixto. Inflorescencia extra-axilar, 1 por nudo, congestionado-racemiforme, con 1 hasta 3 flores, indumento mixto, pedúnculo 0–3.8 cm, eje hasta 3.5 mm, pedicelo 1.8–6.8 cm, brácteas deciduas, lineares, 4.2–8.3 × 0.6–1.3 mm; cáliz con tubo 1.5–2.3 mm, coléteres 2 hasta 8 por seno, algunas veces formando un anillo casi continuo, lobos patentes a reflejos, lanceolados o angostamente elípticos con ápices agudos a acuminados, 10.3–18 × 3.6–9 mm, con indumento mixto abaxialmente, glabros adaxialmente o adpreso-pilosos en la mitad distal, verdes o con tintes púrpuras; corola rotácea, estivación imbricada y dextrorsa, verde pálida con reticulaciones verde obscuras a púrpura-cafés, tubo 4.5–5 mm de largo, glabro o dispersamente hispídulo abaxialmente, adaxialmente con parches de tricomas unicelulares, rizados, vidriosos, 0.1 mm de largo, el anillo faucial angosto, erecto, 5-lobado, 0.2–0.6 mm de alto entre los lobos, 0.7–1.6 mm de alto en los lobos, pubescente en los lobos o en todo el anillo, lobos de la corola asimétricamente ovados o elípticos con ápices agudos, 18–25 × 6.8–13 mm, patentes, con indumento mixto abaxialmente, excepto glabros en las partes traslapadas en la yema, tricomas largos 0.1–0.3 mm, adaxialmente glabros excepto con una banda de tricomas vidriosos (continuos desde el tubo) cerca de uno de los márgenes y uniéndose al margen cerca del ápice; ginostegio con estípite 2.2–2.5 mm de largo, prominentemente 5-alado, corona una copa 5-lobada con márgenes erectos, base adnada a la corola, 2.5–3.2 mm de ancho, margen libre rugoso, 0.2–1 mm de alto entre los lobos, 1.2–2.2 mm de alto en los lobos, blanca, apéndices dor-

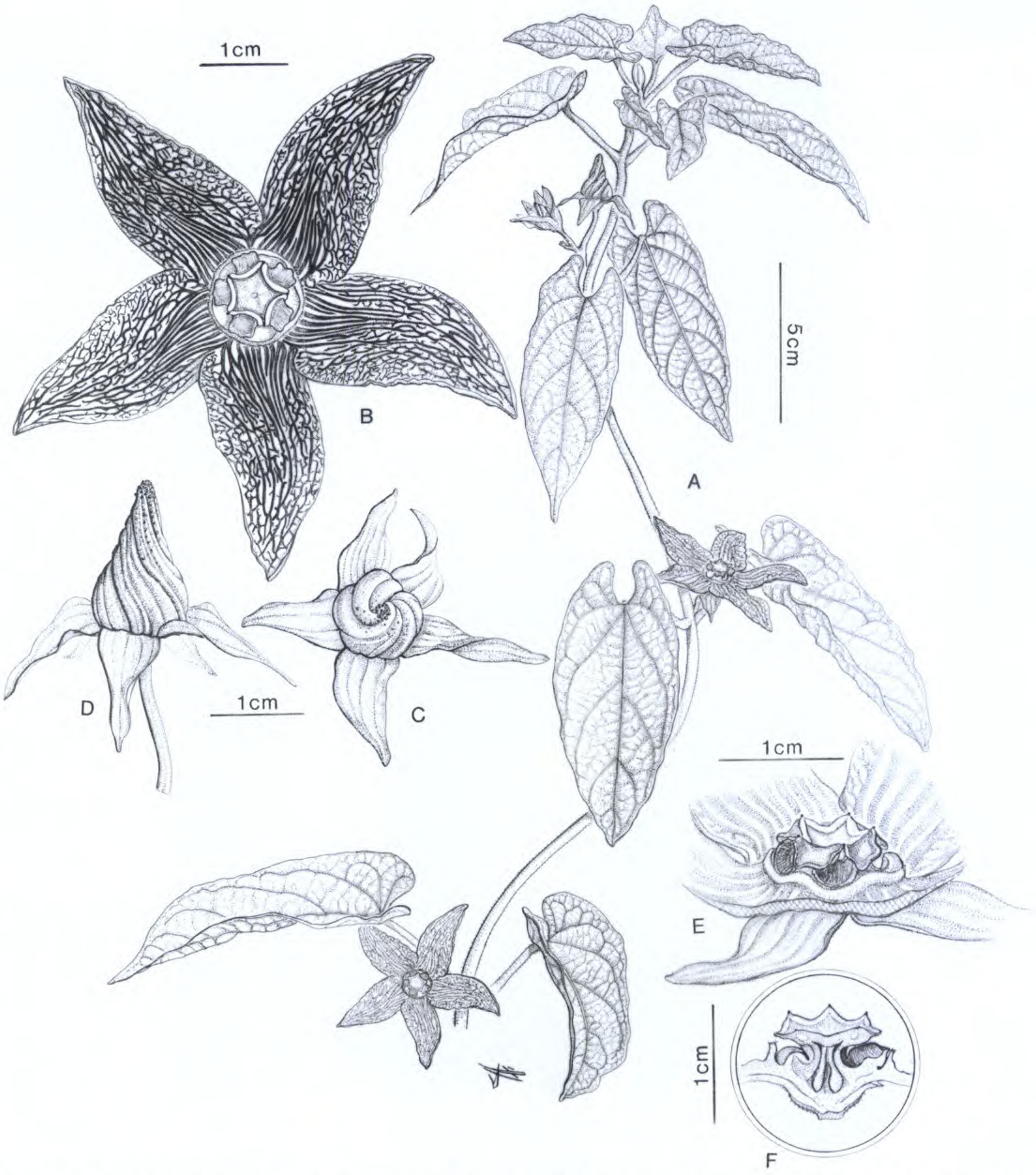

Figura 1. *Gonolobus incerianus* W. D. Stevens & Montiel. —A. Rama con flores. —B. Flor, vista de frente. —C. Yema, vista desde arriba. —D. Yema, vista lateral. —E. Flor, vista lateral. —F. Flor, corte transversal. Ilustración basada en *Stevens & Martínez 25654.*

sales de las anteras patentes o algo deflexos, trapezoidales, cóncavos adaxialmente, 1.8–2.7 mm de largo y 2.9–3.2 mm de ancho en el ápice, carnosos, rojos o púrpuras, alas rectas, paralelas, 2.3–3 × 0.2–0.5 mm; corpúscula 0.35–0.38 × 0.1–0.13 mm, sagitada, rojo-café hasta casi negra, transladores 0.3–0.45 × 0.15–0.23 mm, polinios 1.48–1.95 × 0.45–0.55 mm, asimétricamente obovados, excavados y estériles en la base; estilo con ápice cóncavo, verde, 4.4–5 mm de ancho. Folículos maduros no conocidos, aparentemente 3- o 5-alados y glabros; semillas no conocidas.

Esta especie frecuentemente ha sido anotada como *Gonolubus uniflorus* HBK, una especie diferente restringida en su distribución al Valle de México y a las montañas aledañas. *Gonolobus uniflorus* tiene los lobos del cáliz y de la corola más pequeños, más angostos y más agudos; los lobos de la corola son de color verde pálido y sin reticula-

2A

2B

Figura 2. —A. *Gonolobus incerianus.* Flor y ramita, *Stevens & Martínez 25654.* —B. *Gonolobus leianthus.* Flor y ramita, *Stevens et al. 25525* (Guatemala; MO).

ciones de colores, y tienen las bandas de tricomas vidriosos más angostas y casi pegadas a los márgenes en toda su longitud, entre otros caracteres. La *Flora of Guatemala* (Standley & Williams, 1969) erróneamente utilizó el nombre *Gonolobus uniflorus* en la descripción de esta especie. Además equivocadamente rotuló la ilustración (fig. 122) como *Gonolobus donnellsmithianus* L. O. Williams. La nueva especie *Gonolobus incerianus* fue tratada como Gonolobus sp. "A" en la *Flora de Nicaragua* (Stevens et al., 2001).

Gonolobus incerianus está relacionada cercanamente a *G. leianthus* Donnell Smith (Fig. 2B) y tiene una distribución semejante; sin embargo *G. leianthus* tiene los lobos de la corola completamente verdes con un callo blanco brillante a lo largo de uno de los lados de cada lobo, los tricomas abaxiales de la corola más cortos y más delicados, y los lobos del cáliz mucho más anchos y traslapados. *Gonolobus leianthus* es probablemente la especie de flores más grandes del género, y la nueva especie aquí descrita las tiene sólo ligeramente más

pequeñas, aunque mucho más llamativas. El nombre local en El Salvador es "Cuchamper" (por ej. *Villacorta 1126*, MO), lo que significa que es probablemente una especie comestible, ya que este nombre es uno de los que se da a los *Gonolobus* comestibles en Mesoamérica (obs. per.).

Gonolobus incerianus se conoce desde Veracruz y Oaxaca, México, hasta el norte de Nicaragua, en áreas abiertas de nebliselvas, entre 1040 y 2400 m s.m. con la mayor distribución entre 1300 y 2000 m. La especie florece todo el año, mayormente entre abril y octubre. Aunque el hábitat de esta especie ha sido ampliamente perturbado en Mesoamérica por el cultivo de café y la ganadería, es beneficiada por crecer en áreas abiertas y al momento de esta publicación no se detectó ningún problema en su estado de conservación.

Esta especie se nombra en honor de Jaime Incer Barquero (1934–), naturalista nicaragüense y principal impulsor de los estudios botánicos y de la conservación en Nicaragua. Esta hermosa especie, tal vez la más llamativa del género *Gonolobus*, ha sido colectada en Nicaragua en remanentes de vegetación natural, algunos de los cuales todavía se conservan gracias a las gestiones de Jaime Incer.

Parátipos. MEXICO. **Chiapas:** Ejido Nueva Colombia, paraje Plan de la Chabela, cerca Finca Liquidambar, *Bachem & Rojas 736* (MO); paraje Koltol Te', *Breedlove 6115* (CAS), *6239* (F); 1 mi. S of Mitontik Center along road from San Cristóbal de las Casas to Chenalo, *Breedlove 9795* (CAS, F); 3 mi. S of Aguacatenango along road to Pinola Las Rosas, *Breedlove 10572* (CAS, F, US), *11167* (CAS); along river of Chik Ha', barrio Yashanal, paraje of Matsab, *Breedlove 11128* (CAS, F); paraje Kulak'tik, *Breedlove 14587* (CAS, F), *Méndez 282* (CAS); near Colonia Carmen Xhan & ruins of Chinkultik, *Breedlove 52010* (CAS, MO); Selva Negra, 10 km above Rayón Mezcalapa along road to Jitotol, *Breedlove 52684* (CAS, MO); 5 km SE of Jitotol along road to Bochil, *Breedlove & Thorne 20422* (CAS, MO); 10 km al S de las Lagunas de Montebello, cerca de las ruinas de Chincultic, *Cabrera 3082* (MEXU), *Espejo et al. 1175* (UAMIZ); 1 km al SW del entronque a Simojoven de Allende, sobre la carr. Escopetazo–Pichucalco, *Cabrera et al. 3059* (MO); Cascade Mts., *Ghiesbreght 662* (MO); 7 km N of Jitotol on road to Pichucalco (Hwy. 195), *Hammel et al. 15699* (MO); Amatenango, *Hernández 1491* (MO); 4 mi. N of Jitotol, *Lathrop & Thorne 7244* (CAS); Ti' Akil, 4 km al E de Amatenango del Valle, *López 62* (CAS); Volcán Tacaná, camino entre Talquián y Chiquihuite, *Martínez & Reyes 20449* (MO); Cerro Tres Picos, *Martínez et al. 18573* (MO); Volcán Tacaná, entre Talquián y Toniná, *Martínez et al. 20749* (MO); Carelas, near Motozontla, *Matuda 5521* (F, TEX, UC); paraje Kurus Chén, *Méndez 4145* (MEXU); Volcán Tacaná, *Miller et al. 2641* (MEXU, MO); Chabul Ch'en, 2 km del pueblo a Cancuc, *Sántiz 275* (CAS); 45 km NE of Huixtla on hwy. to Motozintla, *Stevens & Martínez 25654* (MEXU, MO); Río Hondo, 3 mi. N of Jitotol, *Thorne & Lathrop 40158* (CAS); 2 km from top of ridge at Puerto El Viento, 12 km NW of Pueblo Nuevo, *Tillett 636-74* (CAS, F). **Oaxaca:** Coicoyán, *de Avila 312* (MO); Cuyamecalco, *Conzatti et al. 2459* (F, MO); Rancho La Ardilla a 6 km al E de Totontepec, *Ramírez 776* (MO). **Veracruz:** Zimapán, 14 Aug. 1912, *Arsene s.n.* (G). GUATEMALA. **Alta Verapaz:** Samac, *Johnson 285* (F); Río Frío, entre Tactic y Santa Cruz, *Molina & Molina 12225* (F, NY, TEX); Cobán, *Standley 69423* (F, MO), *69492* (F), *91285* (F), *Tuerckheim II 300* (G), *II 1300* (F); San Juan Chamelco, *Wilson 40894* (F); entre San Pedro Carchá y Sacoyoú, *Molina & Molina 12098* (F); 9 mi. E of San Pedro Carchá, *Wilbur 14878* (F). **Baja Verapaz:** Pantín, *Molina & Molina 27828* (F); Finca Llano Largo, *Pöll 2704* (UVAL). **Chimaltenango:** San Martín Jilotepeque, *Johnston 1749* (F). **Huehuetenango:** San Sebastián, *Molina & Molina 26506* (F); Río Blanco, *Molina & Molina 26576* (F), *Molina et al. 30234* (F, MO), *Williams et al. 22349* (F, TEX); above La Libertad, on Cerro Pueblo Nuevo, *Steyermark 50980* (F, MO). **Jalapa:** Cerro Alcoba, just E of Jalapa, *Steyermark 32511* (F). **Quetzaltenango:** Vuelta del Tigre, below Santa María de Jesús, *Standley 68181* (F); Río Samalá, near Santa María de Jesús, *Standley 84766* (F, MO). **Quiche:** Chunamá, betw. Pulay & San Juan Cotzal, *Proctor 25012* (CAS, TEX). **Santa Rosa:** Laguna de Ayarza, *Heyde & Lux ex Smith 4006* (F, G, MO). **Sololá:** San Marcos La Laguna, Atitlán, *Flores 2589* (USCG); Entre parcelas Pampojilá, *MacVean 9824* (MO, UVAL), *Mansilla 9967* (MO, UVAL). HONDURAS. **Francisco Morazán:** Peña Blanca, Montaña La Tigra, *Molina 11053* (F). **Intibucá:** La Esperanza, Balneario Español, *Barkley & Hernández 40322* (F), *Martínez & Bejarano 112* (MO). **Ocotepeque:** Belén Gualcho, 40 km al E de Nueva Ocotepeque, *Nelson et al. 3689* (MO); El Moral, Cordillera Merendón, *Molina 22296* (F). EL SALVADOR. **La Libertad:** Cráter del Boquerón, *Renderos et al. 343* (B, LAGU, MO). **Santa Ana:** P. N. Montecristo, *Berendsohn 1053* (MO), *Monterrosa 149* (MO); Potrero Grande, *Reyna & Villacorta 1442* (LAGU, MO); Volcán El Chingo, *Villacorta 1126* (B, LAGU, MO); Volcán de Santa Ana, Finca Los Andes, *Serrano 11* (MO). NICARAGUA. **Estelí:** Cerro Quiabú, al NO de Estelí, *Moreno 1361* (MO). **Jinotega:** Volcán Yalí, *Atwood & Neill AN129* (F, MO, TEX); 23.5 km (by road) NE of Hwy. 1 at Estelí & 2.8 km SE of Laguna Miraflores, *Henrich & Stevens 392* (MO); Finca Aventina, sierra E of Jinotega, *Standley 9943* (F). **Madriz:** R. N. Tepesomoto, La Patasta, *Rueda et al. 13736* (MO). **Matagalpa:** 13 km N of Matagalpa along Hwy. 3 to Jinotega, *Croat 43127* (MO); betw. Santa Lastenia & Disparate de Potter, *Molina & Molina 30491* (F, MO); Finca Santa María de Ostuma, *Molina 31619* (F, MO); camino a Cerro Carlota, 2 km de la carr. a El Tuma, *Moreno 15690* (MO).

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Redefinition of *Symbolanthus* to Include *Wurdackanthus* (Gentianaceae–Helieae)

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Abstract. The genus *Wurdackanthus* (Gentianaceae–Helieae) comprises two species restricted to northern South America. *Wurdackanthus argyreus* is a narrowly distributed species on tepuis of southern Venezuela and northern Brazil, and *W. frigidus* only occurs in the Lesser Antilles. Recent phylogenetic investigations have shown that *Wurdackanthus* is paraphyletic with respect to *Symbolanthus*, and that no clear morphological distinction exists between these two genera. These two genera share several unique morphological, anatomical, and molecular synapomorphies, such as (1) pollen released as tetrads and with a coarsely reticulated exine, especially in the equatorial zone (*Symbolanthus*-type pollen); (2) elongated dome-like seed testa cells; and (3) molecular characters from the *trn*L intron, *mat*K, internal transgenic spacer (ITS), and 5S non-transcribed spacer (5S-NTS) DNA regions. Based on the concept of monophyly and the presence of structural support, we here include *Wurdackanthus* in *Symbolanthus* and provide new synonymy. The new combinations *Symbolanthus argyreus* (Maguire) Struwe & K. Gould and *S. frigidus* (Swartz) Struwe & K. Gould are made herein.

Resumen. El género *Wurdackanthus* (Gentianaceae–Helieae) comprende dos especies restringidas al norte de Sur América. *Wurdackanthus argyreus* se distribuye en los tepuis del sur de Venezuela y norte del Brasil y *W. frigidus* se encuentra únicamente en las Antillas menores. Investigaciones recientes sobre la filogenia del grupo han mostrado que *Wurdackanthus* es parafilético en relación a *Symbolanthus*, y que no existen tampoco diferencias morfológicas claras entre los dos géneros. Los dos géneros comparten varias sinapomorfías morfológicas, anatómicas y moleculares tales como (1) polen en tétradas y con exina abruptamente reticulada, especialmente en la zona ecuatorial (polen del tipo *Symbolanthus*), (2) células de la cubierta seminal elongadas en forma de domo y (3) caracteres moleculares en las regiones de ADN del intron *trn*L, *mat*K, del espaciador interno transgénico (ITS), y del espaciador no transcriptor 5S (5S-NTS). Con base en el concepto de monofília y de la presencia de soporte estructural, incluímos *Wurdackanthus* en *Symbolanthus* y presentamos la nueva sinonímia. Se publican además las combinaciones nuevas *Symbolanthus argyreus* (Maguire) Struwe & K. Gould y *S. frigidus* (Swartz) Struwe & K. Gould.

Key words: Gentianaceae, Helieae, Neotropics, *Symbolanthus*, *Wurdackanthus*.

The genus *Wurdackanthus* Maguire comprises two species in the Neotropics and belongs to tribe Helieae in Gentianaceae (Maguire, 1985; Maguire & Boom, 1989; Struwe et al., 2002a). *Wurdackanthus argyreus*, the type species, is a narrowly distributed species occurring on two mountains in southern Venezuela and northern Brazil. The other species, *W. frigidus*, is present on the islands of Dominica, Guadeloupe, and St. Vincent in the Lesser Antilles. *Symbolanthus* G. Don is one of the most showy-flowered gentian genera in the American tropics with large and brightly colored corollas. The corollas are campanulate, trumpet- or funnel-shaped, and brightly pink, red, to purple (often with white stripes), or white, green, to yellow. *Symbolanthus* species occur from Costa Rica and Panama southward along the Andes in Colombia, Venezuela, Ecuador, Peru, and down to central Bolivia, as well as on the tepuis (table-top mountains) of the Guayana Highlands. The genus is currently being revised, and preliminary data suggest that it contains at least 30 species (Struwe et al., 2002a; Struwe, 2003a, b).

Phylogenetic analyses based on DNA sequences

Table 1. Overview of anatomical and morphological characteristics of *Symbolanthus* sensu stricto and the two species previously classified as *Wurdackanthus*, *S. argyreus*, and *S. frigidus*.

Character	*Symbolanthus* s. str.	*S. argyreus* (*Wurdackanthus a.*)	*S. frigidus* (*Wurdackanthus f.*)
Calyx size	16–45 mm	7–12 mm	7–12 mm
Calyx lobe length as percentage of total calyx length	80%–90%	80%–90%	60%–70%
Calyx lobe apex	acute, acuminate, obtuse	obtuse	obtuse
Corrolla bud apex	tapering	tapering	obtuse
Corolla length	(28–)48–110 mm	40–55 mm	40–58 mm
Corolla color	white, pink, magenta, red, cream, green, yellow	pink, white, magenta	yellow, greenish yellow
Corolla lobe apex	acute or obtuse	obtuse	obtuse
Corona	present	absent	absent
Staminal gaps	present	absent	present
Pollen type	*Symbolanthus*-type	*Symbolanthus*-type	*Symbolanthus*-type
Pollen aggregation	tetrads	tetrads	tetrads
Exine (pollen)	coarsely reticulated, especially around equator	coarsely reticulate, expecially around equator	coarsely reticulate, especially around equator
Testa (seed)	angular, not winged; testa cells rectangular, dome-like, sometimes with band-like thickenings	angular, not winged; testa cells rectangular, dome-like, sometimes with band-like thickenings	angular, not winged; testa cells rectangular, dome-like, sometimes with band-like thickenings
Number of flowers per inflorescence	1–4(–8)	1–3	5–7

of the *trn*L intron, *mat*K, and internal transcribed spacer (ITS), all indicate a common origin of *Symbolanthus* and *Wurdackanthus* (Struwe et al., 2002a). *Wurdackanthus* is shown to be unresolved toward *Symbolanthus*, but together they form a strongly supported monophyletic group. The closest relatives appear to be tetrad-bearing species of *Chelonanthus* (e.g., *C. albus*). However, the ITS and *trn*L intron analyses showed no clear resolution within *Symbolanthus* and *Wurdackanthus* (Struwe et al., 2002a). Gould and Struwe (in press) present a detailed study of these two genera using DNA sequences from the 5S-NTS ribosomal region. This study also shows *Wurdackanthus* as being paraphyletic toward *Symbolanthus*. *Wurdackanthus frigidus* is positioned as the basalmost branch in the group, and the position of *W. argyreus* varies but is never together with *W. frigidus*, thereby never creating a monophyletic *Wurdackanthus* that is sister to *Symbolanthus* (Gould & Struwe, in press).

The floral and vegetative morphologies of *Symbolanthus* and *Wurdackanthus* are similar, and in fact no distinct apomorphic character can be used as a distinguishing trait between these two genera. Possible synapomorphies for *Symbolanthus* and *Wurdackanthus* include pollen being released as tetrads and having a coarsely reticulated exine in the equatorial zone (a.k.a. pollen of the *Symbolanthus*-type; Nilsson, 1970, 2002). Both genera also have testa cells with elongated dome-like cells (Bouman et al., 2002). In conclusion, there is strong molecular and morphological support for a monophyletic *Symbolanthus*, which includes *Wurdackanthus*, but weak support for a *Symbolanthus* in the current stricter sense. Therefore, *Wurdackanthus* is here included in *Symbolanthus*. This new generic circumscription also extends the geographic range of *Symbolanthus* s.l. to the Lesser Antilles in the Caribbean. A generic description of *Symbolanthus* s.l. is provided below (see Table 1 for an overview).

Taxonomic Treatment

Symbolanthus G. Don, Gen. Syst. 4: 175. 1837. *Lisianthus* sect. *Symbolanthus* (G. Don) Bentham, in Bentham & Hooker f., Gen. Pl. 2: 814. 1876. TYPE: *Symbolanthus anomalus* (Kunth) Gilg.

Leiothamnus Grisebach, Gen. Sp. Gent. 205. 1839 [1838]. TYPE: *Leiothamnus anomalus* (Kunth) Grisebach.
Wurdackanthus Maguire, Phytologia 57: 312. 1985. TYPE: *Wurdackanthus argyreus* Maguire.

Herbs, *subshrubs*, *shrubs* to small *trees*, 0.3–5 m tall. *Leaves* opposite, decussate, petiolate to sessile, broadly ovate, obovate to elliptic, rarely linear or narrowly ovate, coriaceous to chartaceous, entire; interpetiolar line or raised ridge present. *Inflorescence* terminal, a 2- to 4(to 11)-flowered cyme (dichasial, sometimes with monochasial branches) or flowers solitary. *Flowers* 5-merous, erect, horizontal, to nodding, slightly zygomorphic; stamens and style slightly zygomorphic and gathered together in the lower side of the corolla mouth; *calyx* persistent and slightly enlarged in fruit (except *S. frigidus*), the lobes ovate to elliptic, imbricate in bud, with a dorsal glandular area on each lobe, sometimes dorsally keeled, hyaline-margined, the lobe apex acute, acuminate, or obtuse; *corolla* apex acute, acuminate, or obtuse, mucronate, the corolla bud apex tapering (obtuse in *S. frigidus*); *stamens* inserted in the lower quarter of corolla tube, with corona-like structure (absent in *S. argyreus* and *S. frigidus*) at the base of the filaments, with staminal pockets between the filaments and the corolla at the insertion point (absent in *S. argyreus*); *ovary* bilocular, superior, with a glandular disk at the base, the placentation axile to parietal with protruding, inrolled placentas; ovules numerous; style long, slender, at least partly persistent in fruit, flattened when dry and in fruit; stigma bilamellate, lobes oblong to ovate. *Capsule* globose to elliptic, leathery, slightly fleshy to woody, often glossy, sometimes nearly berry-like, medially dehiscent or sometimes possibly indehiscent, usually nodding.

Distribution. *Symbolanthus* contains at least 30 species, of which ca. 20 species are distributed in montane areas in Costa Rica and Panama as well as along the Andes in Colombia, Venezuela, Ecuador, Peru, and Bolivia. Eight additional species are known from montane habitats on the tepuis of the Guayana Shield in southern Venezuela, northern Brazil, and western Guyana. *Symbolanthus frigidus* is the only species occurring in the Caribbean and is restricted to the mountains of a few islands of the Lesser Antilles.

1. Symbolanthus argyreus (Maguire) Struwe & K. Gould, comb. nov. Basionym: *Wurdackanthus argyreus* Maguire, Phytologia 57: 312. 1985. TYPE: Venezuela. Amazonas: Cerro de la Neblina, Río Yatua, cumbre 5–18 km W of Cumbre Camp, 1–2 Dec. 1957, *B. Maguire, J. J. Wurdack, & C. K. Maguire 42260* (holotype, NY; isotype, US). [Image available at ⟨http://scisun.nybg.org:8890/searchdb/owa/wwwcatalog.detail_list?this_id=4441562⟩.]

Symbolanthus aracamuniensis Steyermark, in Steyermark et al., Ann. Missouri Bot. Gard. 76: 958. 1989. TYPE: Venezuela. Amazonas: Dept. Río Negro, Cerro Aracamuni, summit, Popa Camp, savanna with small to large patches of forest and stream, 1550 m, 15 Oct. 1987, *R. Liesner & F. Delascio 21940* (holotype, MO; isotypes, NY, VEN not seen).

Distribution. *Symbolanthus argyreus* grows only in dwarf forest and savannas on tepui summits and slopes at altitudes of 1300 to 2200 m of the two tepuis Sierra de la Neblina (both on the Brazilian and Venezuelan sides) and Cerro Aracamuni (Venezuela: Amazonas; Struwe et al., 1999).

Representative specimens. BRAZIL. **Amazonas:** Rio Negro, Rio Cauaburí, Rio Maturacá, Serra Pirapucú, 1300–1700 m, *Silva & Brazão 60928* (NY). VENEZUELA. **Amazonas:** NW tepui of Cerro Neblina massif, 1800 m, *Gentry & Stein 46653* (MO); Río Negro, Camp III, Neblina & Massif, NW Plateau (Arm) 13.5 km ENE of Cerro de La Neblina Base Camp, 1750–1850 m, *Liesner 15997* (MO); Cerro de la Neblina, Río Yatua, W headland, 1700–2000 m, *Maguire et al. 37117* (NY); Cerro de la Neblina, 6.5 km SSE of base camp, 1600 m, *Stein et al. 1617* (NY, U); Cerro de la Neblina, headwaters of Caño Grande, SE portion, 1900 m, *Steyermark 103979* (NY, VEN).

2. Symbolanthus frigidus (Swartz) Struwe & K. Gould, comb. nov. Basionym: *Lisianthus frigidus* Swartz, Prodr. Nov. Gen. & Sp. Pl. Veg. Ind. Occ.: 40. 1788. *Lisyanthus frigidus* (Swartz) Grisebach, Gen. Sp. Gent.: 177. 1839 [1838]. *Helia frigida* (Swartz) Kuntze, Rev. Gen. 2: 428. 1891. *Calolisianthus frigidus* (Swartz) Gilg, Nat. Pflanzenfam. 4(2): 101. 1895. *Chelonanthus frigidus* (Swartz) Urban, Symb. Antill. 3: 334. 1902. *Irlbachia frigida* (Swartz) Maas, Proc. Kon. Ned. Akad. Wetensch. Ser. C. 88(4): 410. 1985. *Wurdackanthus frigidus* (Swartz) Maguire & Boom, Mem. New York Bot. Gard. 51: 9. 1989. TYPE: DOMINICA. "Incolit regionem muscosam montis la Soufriere Insulae Dominicae, [date unknown], *Ponthieu* (holotype, BM; isotype, S not seen). Figure 1.

Lisianthus acuminatus Desrousseaux, in Lamarck, Encycl. 3: 660. 1789, non *Lisianthus acuminatus* Perkins, Engl. Jahrb. 31: 493. 1902. TYPE: Guadeloupe. [Date unknown], *De Badier* (P not seen).

Distribution. *Symbolanthus frigidus* is endemic to montane areas of the high cinder volcano areas of the islands of Dominica, Guadeloupe, and St. Vincent of the Lesser Antilles (Howard, 1989).

Representative specimens. DOMINICA. Upper rainfo-

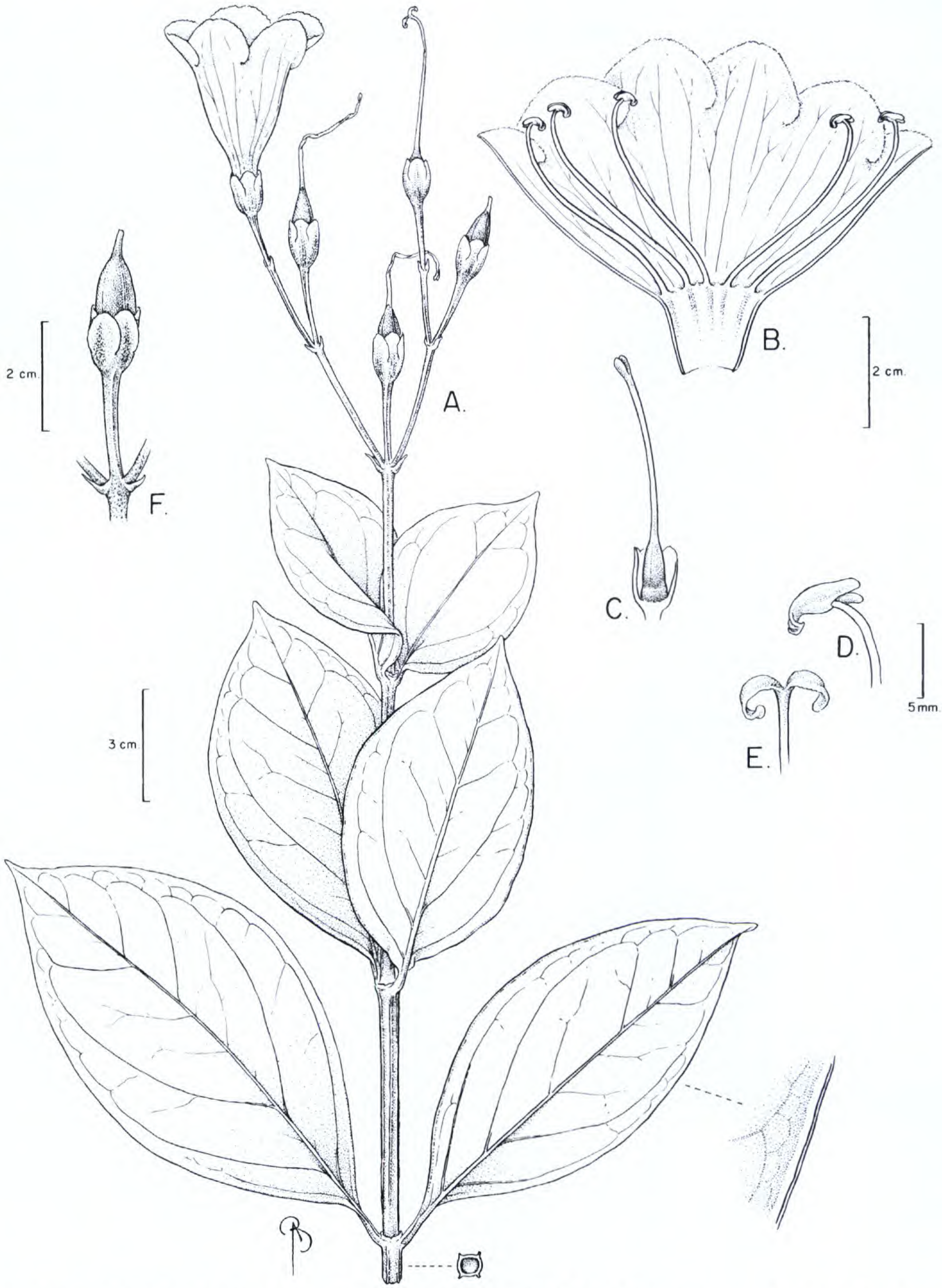

Figure 1. *Symbolanthus frigidus* (Swartz) Struwe & K. Gould. —A. Habit of flowering stem. —B. Opened corolla with stamens with bent filaments. —C. Opened calyx with gynoecium (note glandular base of ovary). —D. Sagittate, slightly recurved anther at anthesis. —E. Bilobed stigma with nearly linear stigma lobes. —F. Part of infructescence showing erect capsular fruit with small persistent style base. Drawing by Bobbi Angell. A–E, *Cooley 8211* (GH, S); F, *Beard 1339* (S).

rest-clad slopes, 3750 ft., Morne Anglais, *Fennah 16* (GH); Valley of Desolation, *Honychurch s.n.* (A); Morne Diablotins, elfin woodland, *Whitefoord 5315* (A). GUADELOUPE. Cone de la Soufriere, 1000–1480 m, *Duss 2306* (NY); Basse Terre, Savans-aux-Ananas, ca. 1000 m, *Proctor 20339* (A); Basse Terre, Mamelle Petit-Bourg, sommet, su vent, 715 m, *Sastre et al. 1916* (A); bois chemus Savane aua, 1050 m, *Stehlé 867* (NY). ST. VINCENT. Summit of Soufriere, *Beard 17* (S); Mt. St. Andrew, elfin woodland, *Beard 1339* (GH, NY, S); Charlotte Parish, on W slope of Soufriere Mtn., *Cooley 8211* (NY, S); ad Soufriere, *Egger 6909* (NY); summit of Soufriere crater, 3000 ft., *Howard 11195* (GH); top of Mt. Soufriere (volcano), *Smith & Smith 18* (NY, GH); Richmond Peak, Morne Garou Mtns., 900–1050 m, *Morton 4949* (GH); St. David Parish, upper outer slopes & rim of Soufriere crater, *Proctor 26007* (GH).

Discussion

Wurdackanthus was not described until 1985 and was typified with *W. argyreus* Maguire (here *Symbolanthus argyreus*) from Sierra de la Neblina in southern Venezuela and northern Brazil (Maguire, 1985). Four years later, Steyermark (1989) described *Symbolanthus aracamuniensis* from Cerro Aracamuni, also in southern Venezuela, which is conspecific with *W. argyreus*, but found on a different mountain (Struwe et al., 1999). *Symbolanthus argyreus* is the only species of *Symbolanthus* investigated so far that appears to lack a corona or corona-like structure in the corolla tube as well as staminal pockets between the corolla tube and the base of the filaments (Struwe et al., 2002b). *Symbolanthus frigidus* is lacking the corona but has the staminal pockets.

Nomenclature and classification of *Symbolanthus frigidus*

The problematic taxonomy of *Symbolanthus frigidus* is reflected in its having been transferred among genera more than any other Helieae taxon. Swartz (1788) originally described it as *Lisianthus frigidus*. Grisebach (1839) included *S. frigidus* in his *Lisyanthus* in the classic work *Genera et Species Gentianearum*, and Kuntze (1891) moved the species to his exceptionally broadly circumscribed *Helia*. Not long thereafter, Gilg (1895) split up *Helia* and included *S. frigidus* in his new genus *Calolisianthus*. Only seven years after this, Urban (1902) transferred *S. frigidus* to another of Gilg's segregate genera, *Chelonanthus*, a view that was not commonly accepted in subsequent treatments. Based on palynological data, Nilsson (1970: 31) suggested that *S. frigidus* (as *Calolisianthus frigidus*) should be transferred to *Symbolanthus*, since it had pollen of the distinct *Symbolanthus*-type. Indeed, *S. frigidus* was soon moved again, this time by Maas (1985), but not to *Symbolanthus*. It was instead transferred to *Irlbachia*, a genus that is now restricted to species with spinose pollen polyads. A few years later, *S. frigidus* was included in the newly described genus *Wurdackanthus* (Maguire & Boom, 1989). In fact, *S. frigidus* has previously been placed in all major tetrad-bearing genera of the tribe Helieae, except for *Symbolanthus* itself, a genus to which Nilsson (1970) suggested this species should belong. With its inclusion in *Symbolanthus*, *S. frigidus* becomes historically the first described *Symbolanthus* species. It predates the previously oldest-known species, *S. calygonus*, by 11 years (Ruiz & Pavon, 1799).

Classification of *Wurdackanthus–Symbolanthus*

The alternatives to including *Wurdackanthus* in *Symbolanthus* are (1) to create a new genus for *W. frigidus* and restrict *Wurdackanthus* to *W. argyreus* only, or (2) to create a new genus for *W. frigidus* and include *W. argyreus* in *Symbolanthus*, since *W. argyreus* is the type of the genus *Wurdackanthus*. However, the molecular support for the clade consisting of *Symbolanthus* s. str., excluding *Wurdackanthus*, is weak (Gould & Struwe, in prep.). Morphological differences between *Symbolanthus* and *Wurdackanthus* are also few, mainly being the absence of a corona and the presence of smaller and less deeply divided calyces in *Wurdackanthus*. Rather, a more broadly circumscribed genus that includes both *Symbolanthus* and *Wurdackanthus* as advocated here, forms a well-supported unit by all available data. Instead of having one or two monotypic genera based on no unique characters and a poorly supported *Symbolanthus* s. str., we prefer a widely circumscribed *Symbolanthus* that is morphologically and molecularly well supported. *Symbolanthus* s.l. is supported by characters such as tetrad pollen of the *Symbolanthus*-type (unique to this group), staminal pockets (except *W. argyreus*), coronas (unique to this group, found in all species except *W. argyreus* and *W. frigidus*), and relatively large corollas (ca. 40–100 mm long) and fruits (ca. 20–40 mm long) as compared to sister taxa in *Chelonanthus* (Gould & Struwe, in press).

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We dedicate this paper in memory of the late Siwert Nilsson (1933–2002), prominent palynologist and gentian specialist from Stockholm, Sweden. Nilsson suggested the transfer of *Wurdackanthus frigidus* to *Symbolanthus* over 30 years ago based on pollen data, a transfer that is officially made here.

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Inclusion of *Neolourya* in *Peliosanthes* (Convallariaceae)

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ABSTRACT. *Neolourya* is included in *Peliosanthes* (Convallariaceae), as their difference is confined to the shape of the style and seems insufficient for generic delimitation. As a result, a new combination, *P. weberi* (L. Rodriguez) N. Tanaka, is proposed. The other two species of *Neolourya*, *N. pierrei* L. Rodriguez and *N. thailandica* K. Larsen, are reduced to synonymy of *P. weberi*, as no appreciable morphological difference is found among them. *Peliosanthes weberi* is characterized chiefly by its slender tortuous style and by the antisepalous anthers often more concealed than the antipetalous ones by the coroniform united filaments.

Key words: Convallariaceae, Indochina, *Neolourya*, *Peliosanthes*.

Rodriguez (1934a) founded the genus *Neolourya* with two species: *N. weberi* L. Rodriguez from northern Vietnam and *N. pierrei* L. Rodriguez from Cambodia. Later, Larsen (1966) added another species, *N. thailandica* K. Larsen from Thailand, to the genus, bringing the total to three. According to Rodriguez (1934a, 1934b), *Neolourya* differs from its most closely related genus, *Peliosanthes* Andrews, by the cylindrical, tortuous slender style (vs. pyramidal or conic style). No other marked difference has been observed between the two genera. The sole difference in their styles seems to be insufficient for warranting *Neolourya* as a separate genus. *Neolourya* has already been regarded as congeneric with *Peliosanthes* by Hutchinson (1959), Jessop (1976), Mabberley (1987, 1997), Conran and Tamura (1998), Tanaka (1999), and Chen and Tamura (2000), but none of these authors carried out nomenclatural transfers between the two genera.

Rodriguez (1934b) distinguished *Neolourya weberi* from *N. pierrei* by the ovate-rounded perianth segments (vs. ovate-lanceolate segments) and by the scape (including the inflorescence) almost equaling the petioles in length (vs. the scape much shorter than the petioles). In his article (Rodriguez, 1934b), he cited only one specimen for *N. weberi* (*Weber s.n.*, type) and two specimens for *N. pierrei* (*Pierre 6689*, type, and *Harmand 1311*). On re-examination of these specimens, the perianth segments of the two species are more or less ovate and do not seem to be significantly distinct in shape (Figs. 1A, B, 2A, B). The two species also do not seem to differ necessarily in the second diagnostic character (viz., the scape length as compared with the petiole). In those specimens, the longest scapes of the two species are equal in length (both 11 cm). The two specimens of *N. pierrei* bear many leaves, and their petioles vary widely in length from 4.5 to 36 cm. On the other hand, the type specimen of *N. weberi* consists of two scapes and two leaves each separately picked from a plant(s) under cultivation in Paris, and both of their petioles measure 11.5 cm. This length falls within the range of variation in the petiolar length of *N. pierrei*. This fact poses the possibility that the type specimen of *N. weberi* by chance bore leaves with petioles equaling the scapes. Only one (type) specimen of *N. weberi* seems insufficient to prove its distinction from *N. pierrei* in the second diagnostic character. Having no other marked difference, *N. weberi* and *N. pierrei* do not seem to be different entities.

Larsen (1966) reported that *Neolourya thailandica* deviates from *N. weberi* and *N. pierrei* by the corkscrew-formed style and by a tendency to form more than two ovules (2 to 4) per locule. However, as Rodriguez (1934a, 1934b) has already described, the last two species have tortuous styles (Figs. 1D, 2E; for *N. pierrei* see also fig. 65-10, -11 in Rodriguez, 1934b), which are not distinguishable from those of *N. thailandica* (fig. 1d in Larsen, 1966; *van Beusekom & Phengkhlai 66* from the type locality (L); Fig. 3E, F from Thai material identifiable as *N. thailandica*). Regarding the ovule number, I examined six ovaries from one living plant from northern Thailand (*Yahara s.n.*, TEU), which coincides well with the description of *N. thailandica*. All of the ovaries were 3-locular. Three of them had only 2 ovules per locule (Fig. 3I). Two ovaries contained 3–2–2 ovules, respectively. One had 3–3–2 ovules. Of a total of 18 locules examined, 14 contained 2 ovules, and 4 contained 3 ovules. On the other hand, *N. weberi* and *N. pierrei* are reported to form 2 ovules per locule (Rodriguez, 1934a, 1934b). As the three species have the char-

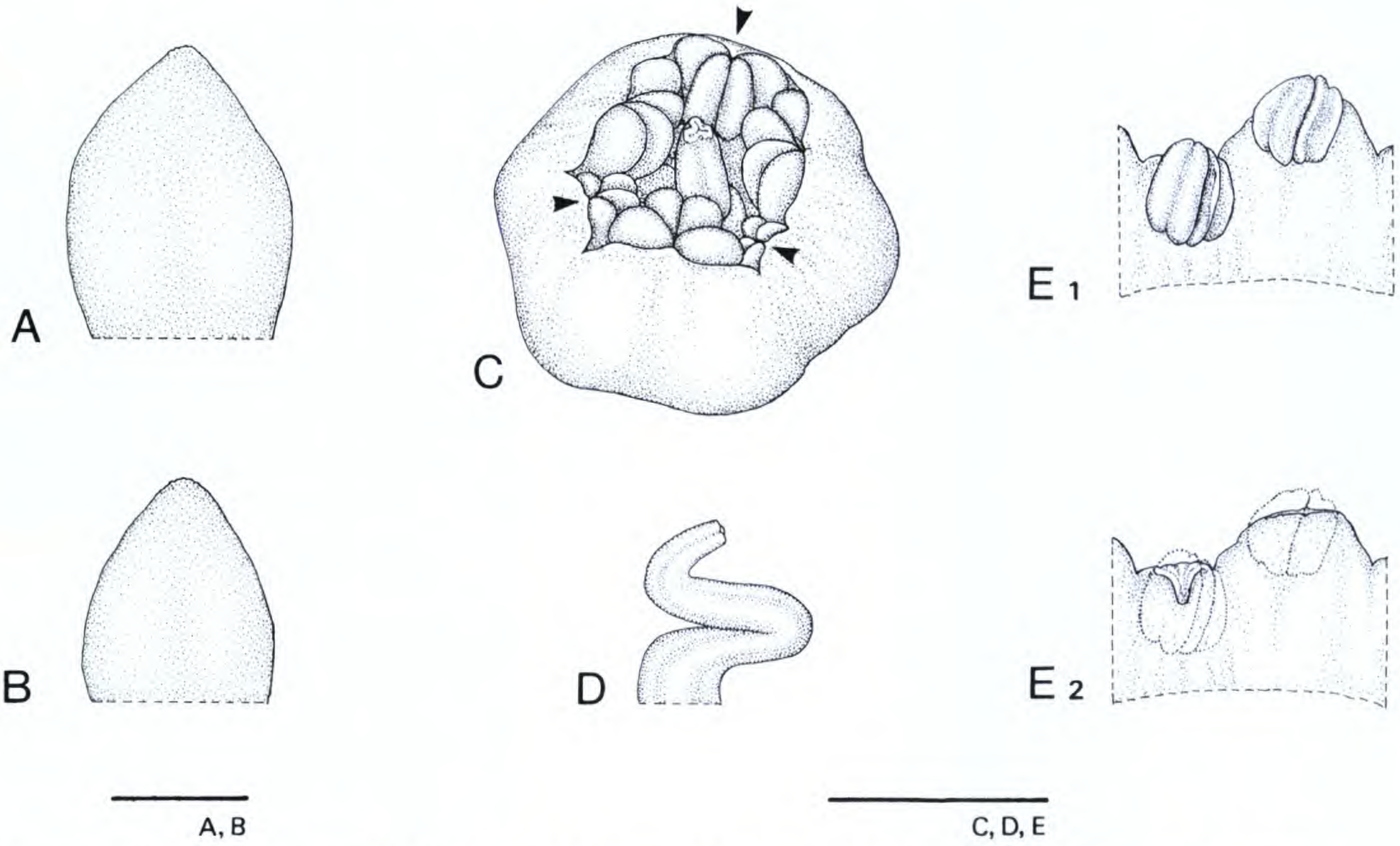

Figure 1. *Peliosanthes weberi* (L. Rodriguez) N. Tanaka (*Neolourya weberi* L. Rodriguez) from northern Vietnam. —A, B. Abaxial view of two outer perianth segments from different flowers. —C. Pistil and monadelphous androecium from bud with perianth removed. Arrowheads point to antisepalous anthers. —D. Style. —E_1. Adaxial view of part of monadelphous androecium with antisepalous (left) and antipetalous anther (right). —E_2. Same as E_1, but depicted with anthers (outlines stippled) removed. Drawn by Noriyuki Tanaka from *Weber s.n.* (P). Scale bars = 1 mm.

acter 2 ovules per locule in common, *N. thailandica* cannot clearly be separated from the other two species by the ovule number. The information on their ovule number is based on limited material, and hence examination of more samples in the future is needed.

Larsen (1966) regarded *Neolourya thailandica* as deviating from *N. weberi* by having a scape much

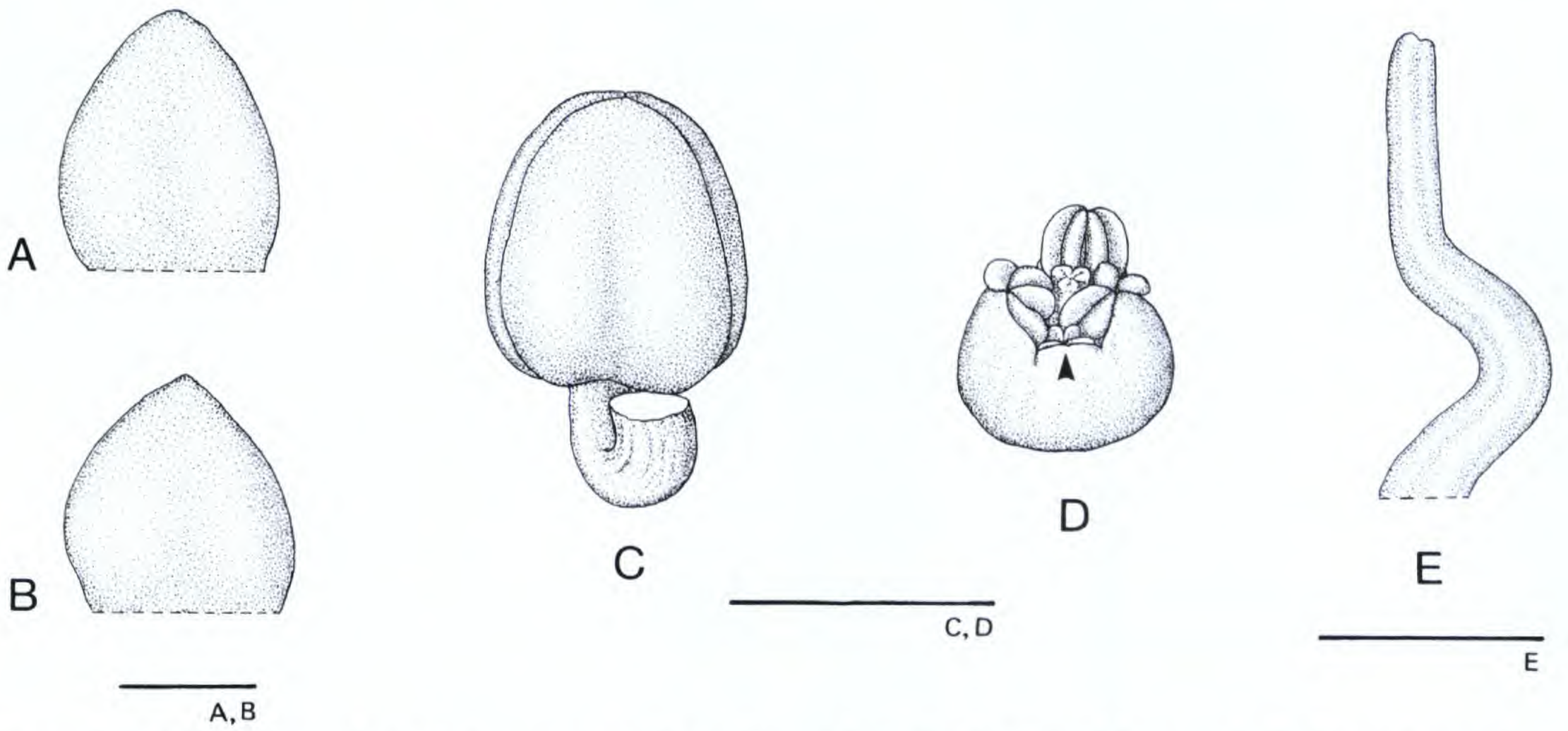

Figure 2. *Peliosanthes weberi* (*Neolourya pierrei* L. Rodriguez) from Cambodia and Laos. —A, B. Abaxial view of two outer perianth segments from different flowers. —C. Young bud showing shallow furrow on outer perianth segment in forefront. —D. Pistil and monadelphous androecium from young bud with perianth removed. Arrowhead points to antisepalous anthers. —E. Style. A, C, D from *Pierre 6689* (P). B, E from *Harmand 1311* (P). Drawn by Noriyuki Tanaka. Scale bars = 1 mm.

shorter than the petiole. According to his description of *N. thailandica*, the scape is 8 cm long, and the petioles are 10–16 cm long. In one specimen from southern Vietnam (*Dournes s.n.*, P), which corresponds well with the description of *N. thailandica*, the scape is ca. 9 cm long and the petioles 9–11 cm long. These measurements are comparable with those of *N. weberi* (see above).

Larsen (1966) also reported that *Neolourya thailandica* can be distinguished from *N. pierrei* by the dorsal furrow of the outer perianth segments. In the few living plants I examined from Thailand that can be identified as *N. thailandica* (e.g., *Yahara s.n.*, TEU), the furrows are generally shallow (Fig. 3A, B, D, E, H) and often rather indistinct (Fig. 3C). Some outer perianth segments of the type specimen of *N. pierrei* (*Pierre 6689*, P) also show traces of a furrow (Fig. 2C) and are not significantly different from the segments of *N. thailandica*.

Larsen (1966) also noted that *Neolourya thailandica* differs from *N. pierrei* by the totally hidden anthers on the incurved united filaments (fig. 1d, e in Larsen, 1966; Fig. 3D, E, G, H). However, the anthers of *N. pierrei* are also more or less hidden by the filaments (Fig. 2D), and it is difficult to distinguish the two species clearly by this character.

The united filaments of the three species are 6-lobed at the apex (Fig. 3D), and the anthers are dorsifixed to the tip of each lobe (Fig. 1E, 3G). The antisepalous anthers, which are opposite to the outer perianth segments, often take a lower position and are more hidden by the united incurved coroniform filaments than the antipetalous ones, which are opposite to the inner perianth segments (Figs. 1C, E, 2D, 3D, E, G, H). This is due to a stronger incurvature (or bend) or shorter length of the lobes of the filaments to which the antisepalous anthers are attached than that of the lobes to which the antipetalous ones are attached (Figs. 1E, 3E, G, H).

The perianth of *Neolourya weberi* is reported as white (Rodriguez, 1934a, 1934b), while that of *N. thailandica* is purplish green (Larsen, 1966) or green (*van Beusekom & Phengkhlai 66*, L). The perianth color of *N. pierrei* is unknown. The difference in floral color alone, even if present, seems insufficient for their specific delimitation.

As no marked difference is found among *Neolourya weberi*, *N. pierrei*, and *N. thailandica*, they are regarded here as conspecific. *Neolourya weberi* and *N. pierrei* were published simultaneously and earlier than *N. thailandica*, as noted earlier. In this paper *N. weberi* is chosen as the name for this unified species in the genus. For the reason stated earlier, *N. weberi* is transferred to *Peliosanthes* as *P. weberi*. *Neolourya pierrei* and *N. thailandica* are reduced to synonyms of *P. weberi*.

Jessop (1976) reduced *Neolourya weberi* and *N. pierrei* to synonymy of *Peliosanthes teta* subsp. *humilis* (Andrews) Jessop. *Peliosanthes weberi* as circumscribed here is particularly unique for its slender tortuous style, and at least by this character it can be delimited from *P. teta* subsp. *humilis* as an independent species.

Peliosanthes was once referred to the family Haemodraceae by Bentham (1883). Rodriguez (1934a, 1934b) also placed both *Neolourya* and *Peliosanthes* in the same family. However, Dahlgren et al. (1985, *Neolourya* not mentioned), Mabberley (1997), Conran and Tamura (1998), and Tanaka (1999) assigned *Peliosanthes* to the Convallariaceae. The appropriateness of the latter assignment is supported by the result of a molecular analysis of the DNA sequence of the *trn*K and *rbc*L regions of the chloroplast (Yamashita & Tamura, 2000).

Peliosanthes is closely related to *Ophiopogon* Ker Gawler and *Liriope* Loureiro (Krause, 1930), and it seems appropriate that these three genera should be grouped into the tribe Ophiopogoneae under Convallariaceae (Dahlgren et al., 1985; Conran & Tamura, 1998). In comparison with *Ophiopogon* and *Liriope*, *Peliosanthes* (including *Neolourya*) is characterized chiefly by the broad leaf blades of which the longitudinal and transverse veins are prominent on both surfaces and by the united staminal filaments, which are fused to the perianth basally (Fig. 3D, E, G, H).

Peliosanthes weberi (L. Rodriguez) N. Tanaka, comb. nov. Basionym: *Neolourya weberi* L. Rodriguez, Bull. Mus. Hist. Nat. (Paris) Ser. II, 6: 97. 1934. TYPE: [Vietnam.] Tonkin, cult. in Hort. Bot. Paris., mai 1905, *Weber s.n.* (holotype, P).

Neolourya pierrei L. Rodriguez, Bull. Mus. Hist. Nat. (Paris) Ser. II, 6: 97. 1934. Syn. nov. TYPE: [Cambodia.] Cochinchine, île de Phu Quoc, 1874, *L. Pierre 6689* (holotype, P).

Neolourya thailandica K. Larsen, Bot. Not. 119: 196. 1966. Syn. nov. TYPE: Thailand. Prachinburi: Khao Yai, 650 m, 1963, cult. in Bot. Gard. Copenhagen, *K. Larsen 10752* (holotype, AAU not seen).

Rhizome subnodose, 3–5 mm diam., producing fibrous roots to ca. 3.5 mm diam. Leaves basal, tufted; blades narrowly elliptic, attenuate at both ends, 13–24.5 × 2.8–5.6 cm; longitudinal veins 13 to 27; transverse veinlets numerous at close intervals, almost parallel; petioles 4–36 cm long. Scape (including rachis of inflorescence) nearly erect, to 13.5 cm long, usually shorter than petioles, dark

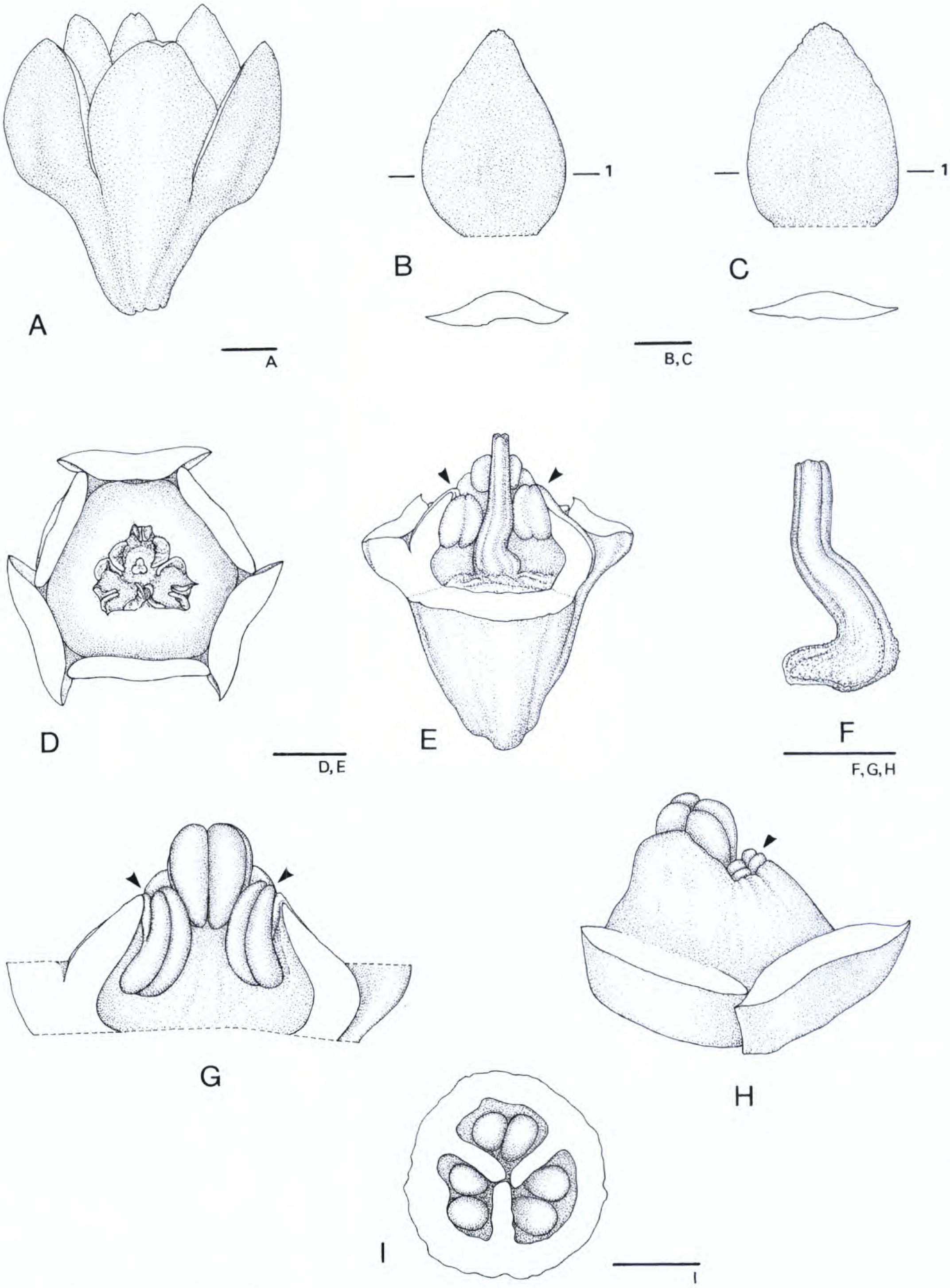

Figure 3. *Peliosanthes weberi* (*Neolourya thailandica* K. Larsen) from northern Thailand. —A. Lateral view of flower. —B, C. Abaxial view of outer perianth segments (above) and their cross sections (below) at position indicated by horizontal line (1), from different flowers. —D. Front view of flower with perianth segments removed, leaving their basal parts. —E. Part of dissected flower. —F. Style. —G. Interior of part of monadelphous androecium. —H. Abaxial view of part of monadelphous androecium. —I. Cross section of ovary with two ovules in each locule. In E, G, H, antisepalous anthers are indicated by arrowheads. Drawn by Noriyuki Tanaka from a living plant (*Yahara s.n.*, TEU). All scale bars = 1 mm.

purple (at least in Thai material). Inflorescence a terminal raceme usually sharing ½ to ¾ of scape; flowers solitary in axils of bracts, usually cernuous, each subtended by 2 bracts, of which inner one shorter than outer; bracts narrowly lanceolate, acute, scarious at margin, to 1.8 cm long (sterile bracts on peduncle to 3 cm long), reducing in size toward apex; pedicels articulate at or near summit, to 7 mm long. Perianth 4–5.5 mm across, 6-cleft, fleshy; segments ovate, obtuse to subacute, 1.7–3.5 mm long, 1.3–2.5 mm wide; tube obconical, 1.7–2.5 mm long; filaments united laterally, fused to perianth basally, part free from perianth annular, coroniform, incurved, 6-lobed at apex, 0.7–1.3 mm high; anthers 6, dorsifixed to tip of lobes of united filaments, 0.6–1 mm long, introrse, orbicular when dehiscent, antisepalous anthers often more hidden than antipetalous ones by united filaments; pistil 1; style slender, slightly attenuate toward apex, tortuous, 2–3 mm long; stigma small, 3-lobed; ovary inferior, 3-locular; ovules 2 to 4 per locule, basal, collateral, anatropous.

Distribution. Thailand, Laos, Vietnam, and Cambodia.

Other selected specimens examined. THAILAND. **Nakhon Ratchasima:** Khao Yai Nat. Park, Khao Kieo, ca. 1300 m, 15 Mar. 1968, *C. F. van Beusekom & C. Phengkhlai 66* (L). **Saraburi:** Muang District, Sahm Lahn forest, 125 m, 13 Apr. 1974, *J. F. Maxwell 74-272* (L). **Chiang Mai:** Doi Sutep, 800 m, 1984, originally collected by *T. Yahara s.n.*, cult. in Bot. Gard. of Tokyo Univ., then at Teikyo Univ., 6 July 2003, *N. Tanaka s.n.* (TEU). LAOS. [Bassac:] Bassin d'Attopeu, 1875–[18]77, *F. F. J. Harmand 1311* (P). VIETNAM. **Dac Lac:** Hau Bôn (Cheo Reo), mai [19]67, *J. Dournes s.n.* (P—2).

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New Combinations in the Florida Flora II

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ABSTRACT. New combinations are made for the following species and varieties within the flora of Florida: *Andropogon elliottii* var. *stenophyllus*, *Arnoglossum ovatum* var. *lanceolatum*, *Dalea albida*, *Dalea gracilis*, *Eupatorium album* var. *petaloideum*, *Harrisia eriophora* var. *fragrans*, *Harrisia gracilis* var. *aboriginum*, *Harrisia gracilis* var. *simpsonii*, *Houstonia procumbens* var. *hirsuta*, *Imperata cylindrica* var. *mexicana*, *Liatris pauciflora* var. *secunda*, *Pisonia discolor* var. *floridana*, *Pityopsis nervosa* var. *tracyi*, *Tephrosia virginiana* var. *mohrii*, *Yucca flaccida* var. *smalliana*.

Key words: Agavaceae, *Andropogon*, *Arnoglossum*, Asteraceae, Cactaceae, Compositae, *Dalea*, *Eupatorium*, Fabaceae, Gramineae, *Harrisia*, *Houstonia*, *Imperata*, Leguminosae, *Liatris*, Nyctaginaceae, *Pisonia*, *Pityopsis*, Poaceae, Rubiaceae, *Tephrosia*, *Yucca*.

As compilation of Florida's vascular plant inventory creeps toward completion, taxa continue to be encountered for which no currently accepted name is available. These taxa—all of them familiar to an earlier generation of botanists, and all of them recognizable in the field—have been orphaned and left nameless by transfer of their generic or specific name to synonymy elsewhere. Other taxa, though not wholly abandoned, have been placed by forced adoption with genera or species to which they do not comfortably belong.

This listing is a continuation of an effort to restore species and infraspecific taxa to ranks appropriate to their morphological differences (cf. Long, 1970; Ward, 2001; Wunderlin & Hansen, 2001). Such an effort is, of course, a necessary component of taxonomic revision, where judgment has changed as to proper generic/specific alignments and names, and where subordinate taxa must either be renamed or abandoned. The number of these unnamed or misnamed subordinate taxa is surprisingly large. It is common practice for persons who undertake taxonomic revisions to reduce to synonymy the less well-defined subordinate taxa that had been recognized by previous workers. Such practice is perhaps commendable, for mindless, wholesale transfer of these lesser taxa would burden the literature with innumerable unneeded names and obscure the distinctions that the revisionist more fully understands.

But when a student undertakes reconsideration of a genus of appreciable size and cannot be as familiar as he might wish with the plants in the field, he may omit those lesser taxa of which he is unsure but that local botanists may recognize. Or he acknowledges the lesser taxon but assigns it a rank that is inappropriate to its characteristics.

The Florida flora, rich both in number of species and in entities that merit infraspecific rank, is undergoing rapid change, not only in the arrival of species new to the state and disappearance of its natives, but change in the names of long-familiar taxa. At times these name changes are unavoidable, for agreed-upon new understanding of specific/generic alignments requires new names to reflect the new status.

As previously (Ward, 2001), in each of the following transfers earlier authors have treated the transferred taxon as worthy of recognition; no new taxa are proposed. And where generic realignments have been proposed and are here accepted, acknowledgment is thereby given to the merit of those changes. As before, though the *International Code of Botanical Nomenclature* (Greuter et al., 2000) permits both subspecies and variety to be employed at infraspecific levels, preference is expressed here for "varietas" as the sole infraspecific rank. Types of the taxa discussed here have not been seen except where so indicated.

At bottom, the determination of rank does not depend solely on explicit morphological criteria. More critical, if unquantifiable, is the experience of a writer to equate new data sets with those with which he is more familiar, the better to develop and maintain a stable, internally consistent nomenclature ranking. The present effort is intended as a step in that direction.

Always, one is reminded of the well-loved phrase of J. M. Greenman (Anderson, 1969), surely true also of lesser rankings, that "Species are but judgments." It is hoped that the judgments expressed here may find support.

AGAVACEAE

Yucca flaccida Haworth var. **smalliana** (Fernald) D. B. Ward, comb. et stat. nov. Basionym: *Yucca smalliana* Fernald, Rhodora 46: 8. 1944. TYPE: U.S.A. Florida: Duval Co., sandy soil, near Jacksonville, May [1893?], *Curtiss 2950* (holotype, GH; isotype, FLAS).

As presciently noted by Fernald (1944: 5), *Yucca* is "always a baffling genus to work with from herbarium material." He was confronted with just that challenge when he addressed the nomenclature of the *Yucca* familiar to him in eastern Virginia. His decision appears unchallenged, that the plant known to Small (1933) as *Y. concava* Haworth represents the true *Y. filamentosa* L.

Two taxa were involved, set apart from other eastern species of the genus by fibers that peel back from the leaf margins (well described by Godfrey, 1988). Though at no point does Fernald refer to these distinctive marginal fibers, they were apparent to early authors; Linnaeus (1753) cited the Gronovius phrase-name: *Yucca foliis lanceolatis acuminatis integerrimis margine filamentosis.* With Virginia the source of the Gronovius material, and with no other *Yucca* native in that area, there is no reason to doubt the Virginia plant known to Fernald is the same as that known to Linnaeus.

Small (1933), however, had applied *Yucca filamentosa* to a similar but more southern plant, one only sparingly extending north to the Carolinas. By Fernald's transfer of *Y. filamentosa* to his Virginia plant, he left the more southern plant without a name. He then chose a Curtiss collection from Jacksonville, Florida, as representative, and named it *Yucca smalliana* in acknowledgment of J. K. Small, who he believed had done much to elucidate these southeastern yuccas.

Though Fernald (1944) discussed in detail the differences between his Virginia *Yucca filamentosa* and the Florida type of his *Y. smalliana,* his unfamiliarity in the field with the second, more southern plant caused him to overlook an aspect difference between these plants that readily permits them when in flower to be distinguished even at a distance. The robust rosette of basal leaves and stocky, floriferous inflorescence of *Y. filamentosa* has made it a popular ornamental of old gardens and cemeteries. It was carried as a grave marker by the Scotch-Irish and German pioneers who moved out of Virginia into early Kentucky, then a generation later into the newly available Indiana territory and throughout the Midwest (cf. Deam, 1940: 316). The southern plant, in contrast, with its tall, mostly naked scape and relatively few flowers, is little cultivated. Fernald also understated the minimal (here, varietal) differences between his new *Y. smalliana* and a third entity recognized by Small, *Y. flaccida* Haworth.

Both of Fernald's taxa were recorded for the Carolinas by Ahles (1964, 1968). He accepted the assignment of *Yucca filamentosa.* But he chose to treat the second entity at varietal level, as *Y. filamentosa* var. *smalliana* (Fernald) Ahles. Since Ahles later (1968) placed *Y. flaccida* in synonymy, it may be argued he erred in using *smalliana,* for there are prior varieties of *Y. flaccida,* which automatically establish the prior varietal autonym *flaccida* (cf. Art. 26.3, Greuter et al., 2000). But Ahles's new combination was valid when published (1964) since no synonymy was then listed.

Yet Fernald's selected type of *Yucca smalliana,* by description, by examination of a duplicate of Curtiss's collection (FLAS 46959), and by its location far to the south of known natural *Y. filamentosa,* readily falls within *Y. flaccida* s.l., a judgment supported by Duncan and Kartesz (1981) and Godfrey (1988). With priority established at varietal level by variety *smalliana* (Fernald) Ahles, Fernald's new entity is properly transferred to *Y. flaccida.*

A two-part caveat is in order, however. Because Haworth's specimens of *Yucca flaccida* are not extant, the validity of the new combination rests on the presumption (and probability) that Haworth's material would now be treated as representative of *Y. flaccida* s. str., as presently recognized. Validity requires also that the several varieties described under *Y. filamentosa* and *Y. flaccida* by Trelease (1902) and others either fall within *Y. filamentosa* or, if *Y. smalliana,* outside the parameters of variety *smalliana.*

CACTACEAE

Harrisia eriophora (Pfeiffer) Britton var. **fragrans** (Small) D. B. Ward, comb. et stat. nov. Basionym: *Harrisia fragrans* Small, in Britton & Rose, The Cactaceae 2: 149. 1920. TYPE: U.S.A. Florida: St. Lucie Co., hammock on sand dune 6 mi. S of Ft. Pierce, 20 Dec. 1917, *J. K. Small 8457* (holotype, NY; isotypes, GH, US).

Harrisia gracilis (P. Miller) Britton var. **aboriginum** (Small) D. B. Ward, comb. et stat. nov. Basionym: *Harrisia aboriginum* Small, in Britton & Rose, The Cactaceae 2: 154. 1920. TYPE: U.S.A. Florida: Manatee Co., hammock, Terra Ceia Island, 29 Apr. 1919, *J. K. Small, Cuthbert & DeWinkler s.n.* (lectotype, designated by Benson (1982: 934), NY; isolectotype, US).

Harrisia gracilis (Miller) Britton var. **simpsonii** (Small) D. B. Ward, comb. et stat. nov. Basionym: *Harrisia simpsonii* Small, in Britton & Rose, The Cactaceae 2: 152. 1920. TYPE: U.S.A. Florida: Monroe Co., hammock near Flamingo, May 1919, *J. K. Small s.n.* (lectotype, designated by Benson (1982: 934), NY).

After Britton (1908) set *Harrisia* apart from the all-inclusive genus *Cereus* Miller, his protege, J. K. Small (in Britton & Rose, 1920), placed names on the forms he encountered in southern Florida. The influence of Benson (1982), however, who preferred retention of a comprehensive *Cereus,* has reduced attention given to these endemic Florida segregates. The three taxa addressed here are consistently given recognition (Benson, 1982; Austin, 1984; Wunderlin, 1998), but at different levels.

In the judgment of Austin (1984), whose field knowledge of these plants is unequaled, the small differences between the Florida taxa of *Harrisia gracilis* (his *Cereus gracilis*) and the differences that separate them from their putative parent (the non-Florida, typical *H. gracilis*) justify varietal status. Benson (1982) also employed varietal rank in *Cereus.* Both authors retained Small's *H. fragrans,* but at varietal level in *Cereus.* The increasing acceptance of a moderate dissection of the larger *Cereus,* by recognition of the segregate genus *Harrisia,* makes the new combinations necessary.

These plants have been classified by the Florida Department of Agriculture as "endangered" and as such have protection of law. Because the Florida statute (F.S. 581.185) does not provide for classification of infraspecific taxa, they are listed as *Harrisia eriophora* and *H. gracilis.*

COMPOSITAE

Arnoglossum ovatum (Walter) H. Robinson var. **lanceolatum** (Nuttall) D. B. Ward, comb. et stat. nov. Basionym: *Cacalia lanceolata* Nuttall, Genera N. Amer. Plants 2: 138. 1818. TYPE: U.S.A. "Florida" [on label], [date?], *Baldwin s.n.* (lectotype, designated here, PH).

Though Nuttall stated his new species to have been provided to him by (William) Baldwin, he imprecisely noted its source as "Georgia and Florida" and did not designate a type. The only appropriate specimen (PH) is labeled simply "(Nutt.)" and "Florida." The present selection formalizes Nuttall's apparent intent.

The conventional treatment of *Cacalia* L. (cf. Pippen, 1978) is now abandoned as irretrievably ambiguous (Wagenitz, 1995; Brummitt, 1998; Nicolson, 1999), with all species reassigned to other genera. Though Kral and Godfrey (1958) understood (and well illustrated) two distinct varieties in what is now *Arnoglossum ovatum,* subsequent authors have failed to give status to Nuttall's narrow-leaved variant.

Eupatorium album L. var. **petaloideum** (Britton) R. K. Godfrey ex D. B. Ward, comb. et stat. nov. Basionym: *Eupatorium petaloideum* Britton, in Small, Bull. Torrey Bot. Club 24: 492. 1897 ["*petalodium,*" corr. Small, 1903: 1168]. TYPE: U.S.A. Florida: Duval Co. [1892?], *Curtiss 1190* (lectotype, designated here, NY).

Though the accomplishments of Robert K. Godfrey in clarifying the southeastern flora were many (cf. Kral, 2001), one of his major efforts failed to reach publication and is thus little recognized. This was Godfrey's prolonged and detailed field study of the genus *Eupatorium.* Through the 1960s and early 1970s he devoted many hundreds of hours to tracing down and visiting the type localities of the numerous names assigned to southeastern members of this genus. Repeatedly he concluded (pers. comm.) that certain of these names did not deserve the oblivion to which later authors had assigned them.

Eupatorium petaloideum Britton in Small (1897) was one such name. In the field Godfrey found plants that matched Britton's description, commonly not in association with *E. album* and distinguishable from that species. He maintained that Britton's taxon "has to be recognized at some level apart from *E. album*" (pers. comm., Feb. 1987). Though this judgment—never placed in print—is in contrast with that of Cronquist (1980), Clewell (1985), and Wunderlin (1998), Godfrey's superior field experience justifies retention of the taxon at a subordinate level.

Liatris pauciflora Pursh var. **secunda** (Elliott) D. B. Ward, comb. et stat. nov. Basionym: *Liatris secunda* Elliott, Sketch 2: 278. 1822? TYPE: U.S.A. Georgia: Savannah, *S. Elliott s.n.* (holotype, CHARL presumed lost).

Following the monograph of Gaiser (1946), two previously confused Florida taxa of *Liatris* have seemed clearly defined. *Liatris pauciflora* Pursh was described as having the stem and leaves glabrous, with an erect, racemose, or paniculate inflorescence; *L. secunda* Elliott was distinguished by the stem short-pubescent, and the inflorescence racemose with heads frequently secund. [Other authors (Small, 1933; Clewell, 1985; Wunderlin,

1998) supplemented these small differences with the observation of eglandular phyllaries in *L. pauciflora* and glandular-dotted phyllaries in *L. secunda*, a characteristic seen neither by Gaiser nor apparent on recent collections (FLAS, FSU).] But the weak morphology was not critical; the two taxa were allopatric, with *L. pauciflora* in the central and northern peninsula and sparingly into southeastern Georgia, and *L. secunda* disjunct, in the western panhandle and extending northward through Georgia and into the Carolinas.

The pattern shown by these two taxa is quite familiar, with a widely distributed continental population and a near-endemic peninsular population, a presumed consequence of Pleistocene glacial flooding and isolation. But, barring knowledge of origin, the two are separable on little more than the difference in pubescence, with perhaps a greater tendency in *Liatris secunda* toward secund-branched inflorescences (itself a consequence of an arching stem). If they were sympatric, specific rank would be unlikely to have been proposed. In view of the real but minor observable differences, varietal rank is sufficient.

Pityopsis nervosa (Willdenow) Dress var. **tracyi** (Small) D. B. Ward, comb. et stat. nov. Basionym: *Chrysopsis tracyi* Small, Southeast U.S. 1182, 1339. 1903. TYPE: U.S.A. Florida: Manatee Co., in sand, Palma Sola, 3 Dec. 1901, *Tracy 7713* (holotype, NY).

The judgment as to whether a comprehensive *Chrysopsis* Elliott should also encompass *Pityopsis* Nuttall (Dress, 1953; Cronquist, 1980) is progressively moving toward the negative (Small, 1933; Dress, 1975; Clewell, 1985; Semple & Bowers, 1985; Wunderlin, 1998). But Semple and Bowers (1985) misplaced the large-headed *Pityopsis tracyi* Small by assigning it varietal status within the small-headed *P. graminifolia* (Michaux) Nuttall. As clearly recognized by Dress (1953, 1975), the large-headed complex is best distinguished as *P. nervosa*. Within *P. nervosa* s.l., variety *nervosa* (with narrow, ascending leaves) occurs throughout the state, and variety *tracyi* (with broad, spreading leaves) is endemic in the peninsula (north to Marion County).

GRAMINEAE

Andropogon elliottii Chapman var. **stenophyllus** (Hackel) D. B. Ward, comb. et stat. nov. Basionym: *Andropogon virginicus* L. var. *viridis* Curtiss ex Hackel in DC. subvar. *stenophyllus* Hackel, in DC., Monogr. Phanerog. 6: 411. 1889. TYPE: U.S.A. Florida: *Chapman s.n.* (lectotype, designated by Campbell (1983: 217), W; isolectotype, W).

By its very quality, the excellent monograph by Campbell (1983) of the *Andropogon virginicus* complex has deflected later workers from inclination to challenge one name change imposed on a widespread member of the group. Within this difficult genus the species known since Chapman's first flora (1860) as *A. elliottii* Chapman stands out with its distinctive overlapping and inflated sheaths. Campbell rejected this name, replacing it with the previously questionable and unused *A. gyrans* Ashe.

Campbell (1983) made the novel argument that *Andropogon elliottii*, even though Chapman's materials and description were unmistakably this species, is nevertheless based on *A. argenteus* Elliott (1816) since Chapman parenthetically included that name (a synonym of *A. ternarius* Michaux) at the bottom of his original description.

As a replacement name Campbell selected *Andropogon gyrans* Ashe (1898). This name, however, had no holotype, and Campbell acknowledged "the equivalence . . . is questionable" of the Ashe specimen he selected as a neotype. Hitchcock and Chase (1951: 812) had referred Ashe's name to *A. elliottii*, but with a query.

Campbell is incorrect in claiming *A. argenteus* Elliott as Chapman's basis. Chapman had clearly indicated he did not accept Elliott's name (since it was a homonym of *A. argenteus* DC.) and in his later revision (Chapman, 1897) omitted the reference entirely. With restoration of *Andropogon elliottii* Chapman, the infraspecific taxa defined by Campbell become: *Andropogon elliottii* var. *elliottii* [= *A. gyrans* var. *gyrans*] and variety *stenophyllus* (Hackel) D. B. Ward [= *A. gyrans* var. *stenophyllus* (Hackel) Campbell].

Imperata cylindrica (L.) P. Beauvois var. **mexicana** (Ruprecht) D. B. Ward, comb. nov. Basionym: *Imperata brasiliensis* Trinius var. *mexicana* Ruprecht, Bull. Acad. Sci. Bruxelles 9: 245. 1842. TYPE: Mexico. Vera Cruz: [date?], *Galeotti 5678* (holotype, K).

Two forms of *Imperata* have been introduced into Florida. The first to appear [earliest record: Miami, Mar. 1905, *Britton s.n.* (FLAS, NY)] was identified as *I. brasiliensis* Trinius; it has remained restricted to south Florida. The second [earliest record: Gainesville, 29 Mar. 1937, *Ritchey s.n.* (FLAS)] was introduced as *I. cylindrica* (L.) P. Beauvois; it has spread aggressively throughout most of the state (still rare in south Florida), largely by vegetative

means. This second taxon, known as Cogon-grass, is presently classified in Florida as a Category I invasive weed; on a global scale it has long been ranked as one of the world's top ten worst weeds (Holm, 1969).

Though these taxa are presumed to come from different continents (South America and Asia), and are consistently treated as specifically distinct (e.g., Gabel, 1982), in Florida they can scarcely be distinguished. The most recent field study (Lippincott, 1997), as well as a guide to the state's flora (Wunderlin, 1998), rely on the number of anthers per floret as the sole discriminator, a cryptic and inconsequential basis for species delimitation (one anther in *I. brasiliensis*; two in *I. cylindrica*). Indeed, this character fails in cultivated materials (C. Lippincott, pers. comm., Sep. 2001). There are additional aspect differences [inflorescence narrowly spicate, plants low (to 0.5 m) in *I. brasiliensis*; inflorescences somewhat diffuse, plants taller (to 1.5 m) in *I. cylindrica*]. But separation, both in the field and in the herbarium, remains difficult and uncertain.

Imperata is a poorly understood genus of 39 names (Chase & Niles, 1962) and eight or nine species (Clayton & Renvoize, 1986; Gabel, 1982). One is perhaps presumptuous to make a new combination here, in the absence of a perspective beyond Florida, by uniting taxa that are so widely assumed to be specifically distinct. But the practical difficulty of determining which taxon is present, and the importance of bringing full force to bear in restricting the spread of this pernicious weed, suggests the wiser strategy lies in treating the two taxa as a specific unit.

LEGUMINOSAE

Dalea albida (Torrey & A. Gray) D. B. Ward, comb. et stat. nov. Basionym: *Petalostemon carneum* Michaux var. *albidum* Torrey & A. Gray, Fl. N. Amer. 1: 311. 1838. TYPE: U.S.A. Georgia: Milledgeville, [date?] *Boykin s.n.* (holotype, NY).

Dalea gracilis (Nuttall) D. B. Ward, comb. nov. Basionym: *Petalostemon gracile* Nuttall, J. Acad. Nat. Sci. Phil. 7: 92. 1834. TYPE: U.S.A. "W. Flor." [on label], [date?], *N. A. Ware s.n.* (lectotype, designated here, PH).

Nuttall (1834: 92) reported his new species as "Hab. In the lower part of Alabama and Florida," without designating a type or collector. As indicated by the slips affixed to his specimens (PH), he had received materials from Nathaniel A. Ware (from Florida), from Hezekiah Gates (from Alabama), and from William Baldwin (source not indicated). The first of these was marked by D. K. Wemple in 1965 as "typus," though his published report (1970: 33) stated only "Type in PH." The present selection formally confirms his choice.

The excellent treatment of *Petalostemon* by Wemple (1970) underlies the revision by Barneby (1977), who included all species of *Petalostemon* within the more inclusive *Dalea*. But Barneby, lacking Wemple's Florida field experience, understated the magnitude of differences separating *Petalostemon albidum* (Torrey & A. Gray) Small from the related *P. carneum* (cf. Small, 1933; Wemple, 1970); he assigned the taxon to *Dalea carnea* var. *albida* (Torrey & A. Gray) Barneby. Similarly, he minimized the differences separating *Petalostemon gracile* Nuttall from *P. carneum*; he reduced Nuttall's species to *Dalea carnea* var. *gracilis* (Nuttall) Barneby.

Barneby's view of the generic limits of *Dalea* is accepted. But the taxa so clearly recognized by Small and by Nuttall need restoration to the level of species.

Tephrosia virginiana (L.) Persoon var. **mohrii** (Rydberg) D. B. Ward, comb. et stat. nov. Basionym: *Cracca mohrii* Rydberg, N. Amer. Fl. 24: 163. 1923. TYPE: U.S.A. Florida: Walton Co., near Eucheeana, June 1880, *Mohr s.n.* (holotype, US).

Tephrosia mohrii (Rydberg) Godfrey & Kral is an endemic taxon of the Florida panhandle, known in only two counties (Clewell, 1985). Though similar to the widespread *T. virginiana*, it has been recognized as distinct by Small (1933), Godfrey and Kral (1958), and Clewell (1985). But Wood (1949), Isely (1990), and Wunderlin (1998) have combined it without distinction.

The distinction between *Tephrosia mohrii* and *T. virginiana* is not inconsiderable (cf. Godfrey & Kral, 1958; Clewell, 1985); *T. mohrii* is a much smaller plant, with smaller, less-pubescent leaflets. Even so, *T. virginiana* varies enough within itself (Isely, 1990) to justify the doubt of authors who are not familiar with the endemic variant in the field. An intermediate, varietal status is appropriate. This taxon, as *Tephrosia mohrii*, has been classified by the Florida Department of Agriculture as "threatened," under the criteria of Florida Statute 581.185.

Nyctaginaceae

Pisonia discolor Sprengel var. **floridana** (Britton) D. B. Ward, comb. et stat. nov. Basionym: *Pisonia floridana* Britton, in Small, Fl. Southeast U.S. 411, 1330. 1903. TYPE: U.S.A. Florida: Monroe Co., among lime rocks, Rock Key, [date?], *Blodgett s.n.* (holotype, NY).

The forms of *Pisonia discolor* encountered in Florida may reflect "founder effect" selections from variable Caribbean populations. Bogle (1974) recognized two Florida varieties: variety *discolor* Sprengel (Syst. ii: 168, 1825), and variety *longifolia* Heimerl (Bot. Jahrb. Syst. 21: 627. 1896), both with glabrous to sparsely pubescent leaves. A third variant, *Pisonia floridana*, a plant with "copiously pubescent" leaves, was collected in the mid 1800s on Rock Key, 12 miles west of Key West, and not again seen (Bogle, 1974: 33). Plants with moderately pubescent leaves, perhaps representing this taxon, were found in 1994 on Long Key (R. Hammer, pers. comm., Dec. 1994).

Though the Florida variants perhaps intergrade and likely do not represent major segregates of the circum-Caribbean parental stock of *Pisonia discolor*, no harm is done by making available this third varietal combination *P. discolor* var. *floridana*, that may aid in documenting variability of the Florida entities.

Rubiaceae

Houstonia procumbens (Walter ex J. F. Gmelin) Standley var. **hirsuta** (W. H. Lewis) D. B. Ward, comb. nov. Basionym: *Hedyotis procumbens* (Walter ex J. F. Gmelin) Standley var. *hirsuta* W. H. Lewis, Ann. Missouri Bot. Gard. 53: 378. 1966. TYPE: U.S.A. Florida: Walton Co., Villa Tasso, 1 mi. W of Choctaw[hatchee] Bay, 28 May 1964, *McDaniel 4707* (holotype, FSU).

The coastal-plain wildflower felicitously known to schoolchildren as Fairy-footprints varies greatly in pubescence. This trait was addressed by Lewis (1966) by recognition of the pubescent extreme as *Hedyotis procumbens* var. *hirsuta*. Neither Wilbur (1968) nor Terrell (1996) accepted the variety as a "biologically significant taxon," though Wilbur presented two maps (1968: 310) that recorded distribution of the glabrous and pubescent entities.

Long observation of the species in the field supports the evidence deduced from Wilbur's maps, that nearly all individuals may be readily assigned to one entity or the other (FLAS, D.B.W., annotated). It is true, as originally stated by Lewis and fully confirmed by both Wilbur and Terrell, that the ranges are largely sympatric (though as noted by Wilbur, the pubescent form does not extend as far into South Carolina; it also is essentially absent from southern Florida (D.B.W., pers. obs.; Wilbur, 1968)). Though no argument can be made that these two entities are of high taxonomic significance, the lack of ambiguity in sorting specimens both in the herbarium and in the field makes retention of Lewis's taxa worthwhile.

Lewis (1966), however, was then in an inclusive mode that favored merger of closely related genera; he made the new combination under *Hedyotis*. In more recent years there has been an apparent consensus that *Houstonia* (and *Oldenlandia*) are best held separate (Terrell & Lewis, 1990; Terrell, 1990, 1991, 1996). With restoration of *Houstonia* (Terrell, 1996), Lewis's variety requires a new combination.

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Arisaema menghaiense (Araceae), a New Epiphytic Species from South Yunnan, China

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ABSTRACT. *Arisaema menghaiense* J. T. Yin, H. Li & Z. F. Xu. (sect. *Pistillata* Engler) is described and illustrated as a new species of Araceae from South Yunnan, China. It is closely related to *Arisaema lobatum* Engler in having a globose tuber, trifoliolate leaf blades, a unisexual spadix, and an erect cylindrical appendix. It differs in its epiphytic habit, the inflorescence that appears before the leaf, a green (female) or pale purple (male) spathe with a filiform acumen ca. 60 cm (male) or 25 cm (female) long, a pale green, erect, sessile cylindrical spadix appendix with a few acute neuter flowers basally and anther thecae opening by an apical slit.

Key words: Araceae, *Arisaema*, China, Yunnan.

During our study of tropical plant resources in South Yunnan, China, a new species of *Arisaema* was discovered; it is described here to make the name available for the *Flora of China*.

The genus *Arisaema* Martius was established in 1831 when it included only *Arisaema costatum* (Wallich) Martius (Martius, 1831), which was transferred from *Arum*. The next year, Martius moved two other species, *Arisaema nepenthoides* (Wallich) Martius and *A. speciosum* (Wallich) Martius, into *Arisaema* from *Arum* (Schott, 1832). Today, *Arisaema* comprises more than 170 species (Mayo et al., 1997) and is one of the larger genera of Araceae.

Arisaema menghaiense J. T. Yin, H. Li & Z. F. Xu, sp. nov. TYPE: China. Yunnan: Menghai, Bada, 100°4′E, 22°52′N, epiphyte on tree, 1800 m, 29 Apr. 2002 (fl), *Yin Jian-Tao 38* (holotype, HITBC). Figure 1.

Haec species *Arisaemati lobato* affinis, sed ab eo habitu epiphytico, inflorescentia ante folium, spathae limbo virido (femineus) vel purpurascenti (mas) cum acumine filiformi 25 (femineus) vel 60 cm (mas) longo, appendice viridula, cylindrica, erecta, sessili, inferne florum sterilium rudimentis subulatis sparsim obsita, antherarum thecis rima apicali dehiscentibus differt.

Perennial, dioecious, herbaceous epiphyte; tuber depressed-globose, ca. 5 × 10 cm, renewing seasonally, purple outside with brown spots, 1–1.5 mm diam.; roots whitish, 2–7 cm long, 1–2 mm diam. Leaf (from fruiting plant) 1; petiole cylindrical, green and smooth without spots, 20–30 cm long, ca. 1 cm diam.; leaf blade greenish, membranaceous, trifoliolate; leaflets petiolulate; terminal leaflet ovate, ca. 20 × 10 cm; apex acute; base cuneate, lateral veins numerous, connective vein 2–3 mm remote from the margin, petiolule 15 mm long; lateral leaflets obliquely ovate-lanceolate, ca. 21 × 8 cm; apex acuminate with 5–8 mm filiform tail; base obliquely cuneate; petiolules 8–11 mm long. Inflorescences unisexual, appearing before the leaf; cataphylls 3, membranaceous, pale green, oblong; apex obtuse, 18–23 cm long; peduncle terete, white, ca. 26 × 0.3 cm (male), 25 × 1 cm (female); male spathe tube cylindrical, green, ca. 6 × 1.5 cm, throat margin broadly auriculate, strongly outward recurved; limb greenish purple, ovate-lanceolate, arched, ca. 6 × 5 cm, apex acuminate with a purple tail up to 60 cm long; female spathe tube whitish green, cylindrical, slightly constricted near the throat, ca. 5 × 1 cm; throat obliquely truncate; limb erect, whitish green, ovate-lanceolate, ca. 4 × 3.5 cm; apex acuminate, with a greenish tail up to 25 cm long. Male spadix with basal fertile portion cylindrical, ca. 3.8 × 0.5–0.6 cm, densely flowered; synandria subsessile, purple; anthers 4 to 6, subglobose, dehiscing by an apical slit; appendix sessile, cylindrical, greenish, ca. 3.8 × 0.3 cm; apex obtuse, with a few subulate neuter flowers in lower part; female spadix with basal portion cylindrical, ca. 2.2 × 0.8 cm, densely flowered; ovaries green, 1-loculed, ovoid; stigmas subsessile, discoid; ovules 5 to 6, basal, erect; appendix as in male spadix. Fruiting spadix cylindrical, ca. 5.2 × 1–1.5 cm; appendix ca. 4.5 cm long.

Distribution. China: Menghai County of Yunnan Province.

Phenology. Flowering, April; fruiting, May.

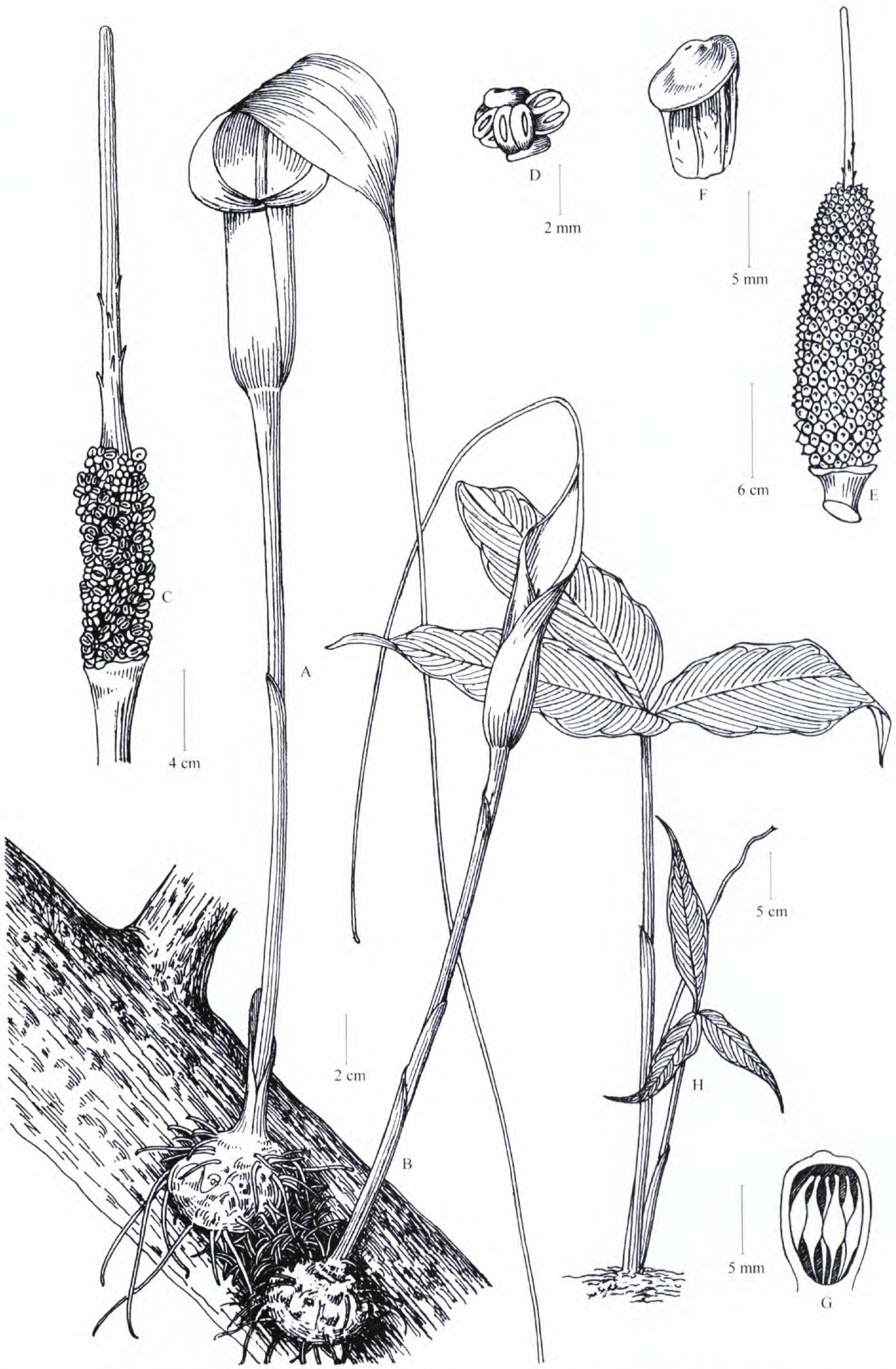

Figure 1. *Arisaema menghaiense* J. T. Yin, H. Li & Z. F. Xu. —A. Male flowering plant with tuber. —B. Female flowering plant. —C. Male spadix. —D. Synandrium. —E. Fruiting spadix. —F. Pistil. —G. Longitudinal section of pistil showing ovules. —H. Leaves of female plant. A, B, C, D from photos of *Yin Jian-Tao 38* (holotype), and E, F, G, H from *Yin Jian-Tao 33* (female, paratype).

Arisaema menghaiense is an epiphytic species in the genus *Arisaema*. This species belongs to section *Pistillata* Engler (Engler, 1920; Hara, 1971; Li Heng, 1979, 1980), which is characterized by a tuber, 3(to 5)-foliolate leaf blade, unisexual spadix, anther cells dehiscing by an apical elliptic or oblong slit, and a cylindrical, erect spadix appendix with nearly truncate base, which exceeds the spathe tube. The following characters distinguish *A. menghaiense* from *A. lobatum* and other species in section *Pistillata*: petiole and peduncle without colored marks appearing before leaves, greenish purple (male) or whitish green (female) spathe limb with a filiform tail up to 60 cm (male) or 25 cm (female) long, sessile cylindrical appendix with a few subulate neuter flowers in the lower part, and the anther thecae dehiscing by an apical slit.

The living tubers of the type and paratype specimens were introduced in Xishungbanna Tropical Botanical Garden in 2002.

The epithet of the new species is derived from the type locality.

Paratype. CHINA. **Yunnan:** Menghai, Mengsong, 100°34′E, 22°3′N, epiphyte on trunk of tree, 1800 m, 29 May 2002 (young fr), *Yin Jian-Tao 33* (HITBC).

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Leptodictyum wallacei (Musci: Amblystegiaceae), a New Species from Texas, U.S.A.

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ABSTRACT. A new aquatic moss from Hext Spring, Texas, is described as *Leptodictyum wallacei*. The new species is distinct in the genus by its small plant size, stiff stem aspect, long leaf cells, firm-walled basal cells, and undifferentiated alar cells.

Key words: Amblystegiaceae, aquatic moss, *Leptodictyum*, Texas.

The southern interior region of the United States (southern Missouri, Arkansas, eastern Oklahoma, and central Texas) is an area of numerous limestone springs. These springs are often fast-running and have cold, clear water. Associated with these springs are a number of interesting mosses such as *Hygroamblystegium noterophilum* (Sullivant & Lesquereux) Warnstorf, *Brachythecium rivulare* Schimper, *Donrichardsia macroneuron* (Grout) Crum & L. E. Anderson, *Fissidens grandifrons* Bridel, *Fontinalis duriaei* Schimper, and the curious *laxirete*-form of *Leptodictyum riparium* (Hedwig) Warnstorf. Recently Brad Wallace collected an interesting moss he found in large masses submerged in Hext Spring, a limestone spring in San Saba County, Texas. He sent it to us for identification, and after careful observation we recognized it as a new species of *Leptodictyum* (Schimper) Warnstorf.

Leptodictyum wallacei B. H. Allen & Magill, sp. nov. TYPE: U.S.A. Texas: San Saba Co., Hext Spring, 4 mi. W of Cherokee, off Ranch Road 501, USGS Magill Mountain quad map, 30°58′49″N, 098°46′22″W, 1555 ft. elev., 13 Dec. 2003, *Brad Wallace s.n.* (holotype, MO; isotypes, BM, DUKE, FH, H, MICH, NY, PC, S, US). Figure 1.

Species haec a *Leptodictyo riparo* plantis rigidis, marginibus foliorum serrulatis, costis latioribus, foliis valde tortilibus ubi siccis pilisque axillaribus rubris differt.

Plants slender in green to yellow-green, dense masses of long, stiff, sparingly branched strands; stems stiff, irregularly branched, in cross section with sclerodermis of 4 to 5 rows of small, yellow or reddish, thick-walled cells, cortical cells enlarged, yellowish to hyaline, firm-walled, small central stand present; paraphyllia absent; pseudoparaphyllia foliose; rhizoids not seen; axillary hairs 3- to 5-celled, lower 1 to 2 cells irregularly quadrate, upper cells rectangular to cylindrical, all cells red. Leaves erect-spreading and individually strongly twisted when dry, erect when wet, evenly spaced, 2.0–2.5 mm long, lanceolate, smooth, long-acuminate to a broad, blunt tip, concave, not decurrent; margins plane to erect, obscurely serrulate to subentire; costae single, broad, to 70 μm wide at base, extending ¾ the leaf length, in cross section cells ± homogeneous, thick-walled; laminal cells linear-rhomboidal to vermicular, firm-walled, upper cells to 70 × 6 μm, median leaf cells to 120 × 6 μm, cells near leaf insertions long-rectangular, firm-walled, at margins cells often subquadrate, alar cells not differentiated. Perichaetial and perigonia not seen. Sporophytes not seen.

Leptodictyum wallacei is a slender moss that grows in large, permanently submerged masses in Hext Spring, Texas. Since the plants grew submerged, it is not possible to determine the orientation of the stems, i.e., whether the primary stems typically grow horizontally or erect, and there is

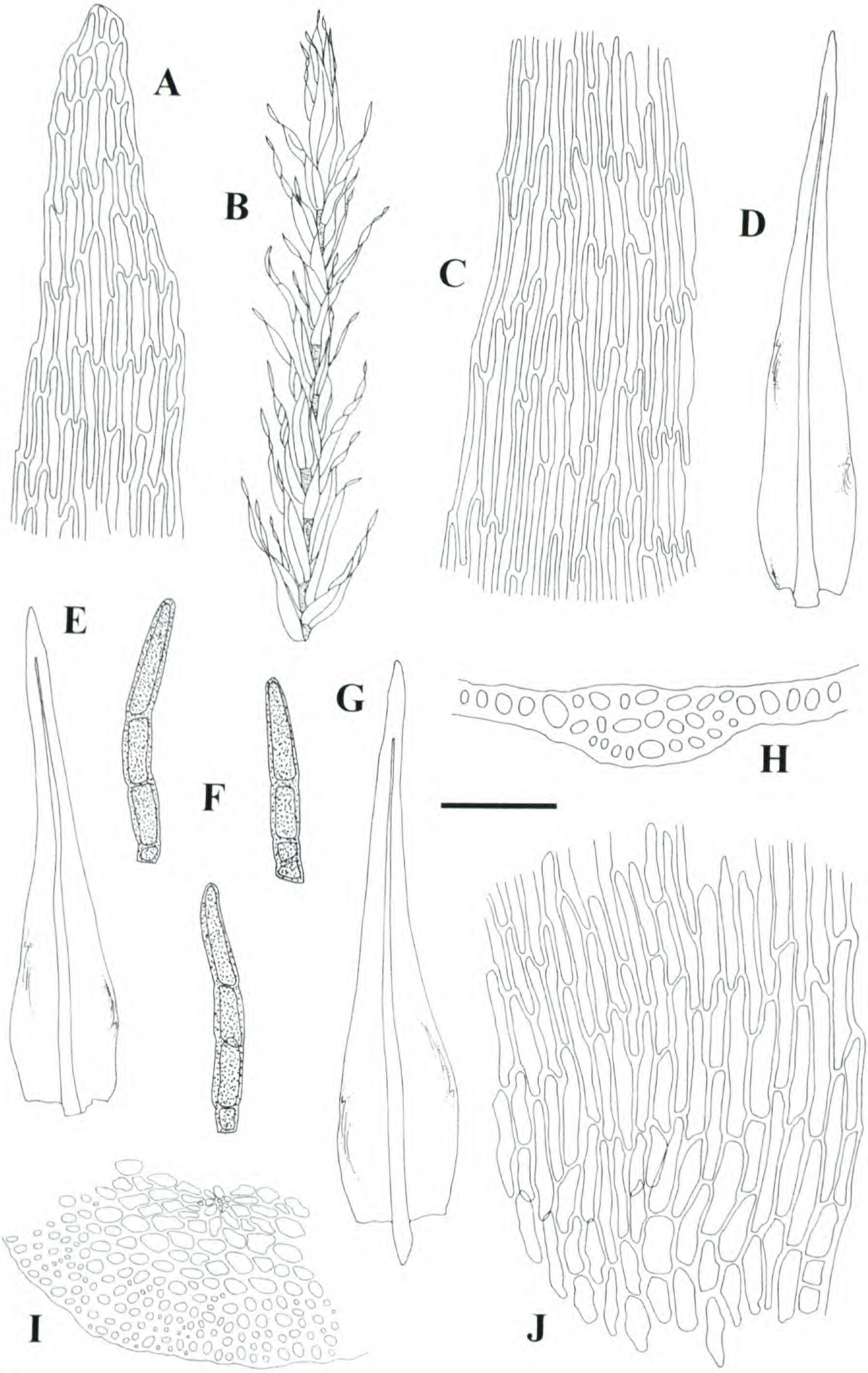

Figure 1. *Leptodictyum wallacei* B. H. Allen & Magill. —A. Leaf apex and upper leaf cells. —B. Habit. —C. Median leaf margin and median leaf cells. —D, E & G. Leaves. —F. Axillary hairs. —H. Costa in cross section, lower part of leaf. —I. Stem in cross section. —J. Basal leaf margin and basal leaf cells. Scale in mm: bar = 0.04 (F, H); bar = 0.06 (A, C, J); bar = 0.08 (I); bar = 0.5 (D, E, G); bar = 1.56 (B).

little stem/branch leaf differentiation. When wet, the leaves of *L. wallacei* are concave and evenly spaced on the stems. The dry plants have a stiff aspect, and the leaves are individually, strongly spirally twisted. The leaves of *L. wallacei* are rounded at the apex, obscurely serrulate throughout, have remarkably long, narrow leaf cells (length: width ratio up to 20:1), and a thick costa that can be 70 μm broad at base.

William Buck (NY) examined this collection, and on the basis of its very broad costa and aquatic habit suggested it could be placed in the genus *Hygroamblystegium* Loeske. This is where we initially concluded it should be placed. However, the exceptionally long, narrow leaf cells and complete absence of alar cell development in this specimen appears to undermine this view. Lars Hedenäs (S) also examined the collection, and in his opinion this moss represents an aberrant form of *Leptodictyum riparium* (Hedwig) Warnstorf. Bernard Goffinet and Alain Vanderpoorten (CONN), on the basis of preliminary molecular analysis, are also of the view that this species is best placed in *Leptodictyum* (Schimper) Warnstorf.

There is in the Interior Highlands of North America a very odd expression of *Leptodictyum riparium* which has been described several times. This odd expression (the *laxirete*-expression of Crum & Anderson, 1981) often grows submerged in slow-moving streams or in springs. In the field, plants of the *laxirete*-expression have the size and aspect of *Fontinalis* Hedwig. Its leaves are often concave, evenly distributed around the stem, and commonly rounded at the apex, which can be twisted when dry. The leaf margins can be obscurely serrulate, the costa is relatively thick, and the long, narrow leaf cells are up to 15:1 (length:width). Plants of *L. riparium laxirete*-expression are lax and fairly large in size, and they differ from typical *L. riparium* in having entirely red axillary hairs (see Allen, *Fontinalaceae Exsiccatae 5*, MO). The axillary hairs in *L. riparium* have one or two red basal cells, but otherwise the cells are hyaline (see Migula, *Cryptogamae Germaniae, Austriae et Helvetiae 401*, MO). The plants from Hext Spring, Texas, share many features with the *laxirete*-expression of *L. riparium*, including having entirely red axillary hairs. Although the two taxa are morphologically similar, the Hext Spring plants are here recognized as a new species on the basis of their smaller size, stiff stems and leaves that have longer cells, firm-walled basal cells, and undifferentiated alar cells. Many of the features noted above are prone to plasticity when they occur in aquatic mosses. Nevertheless, our extensive field experience with the *laxirete*-expression of *L. riparium* in Missouri and Arkansas indicates it never exhibits the distinctive suite of features that characterizes *L. wallacei*.

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Synopsis of *Plinia* (Myrtaceae) in Mesoamerica

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ABSTRACT. The 14 species of *Plinia* known from Mesoamerica are reviewed. Eight new species are described and illustrated: one from Nicaragua, *P. nicaraguensis*; two from Costa Rica, *P. guanacastensis* and *P. moralesii*; and five from Panama, *P. cerrocampanensis*, *P. coclensis*, *P. darienensis*, *P. gentryi*, and *P. panamensis*. One species, *P. salamancana*, is transferred from *Eugenia*. A key to the Mesoamerican species is provided.

RESUMEN. Se examinan las 14 especies de *Plinia* conocidas de Mesoamérica. Se describen y ilustran ocho nuevas especies, una de Nicaragua, *P. nicaraguensis*, dos de Costa Rica, *P. guanacastensis* y *P. moralesii* y cinco de Panamá, *P. cerrocampanensis*, *P. coclensis*, *P. darienensis*, *P. gentryi* y *P. panamensis*. Se transfiere una especie, *P. salamancana*, de *Eugenia*. Se provee una clave para las especies de Mesoamérica.

Key words: Costa Rica, Mesoamerica, Myrtaceae, Nicaragua, Panama, *Plinia*.

This report is the product of a revision of *Plinia* L. undertaken for the Flora Mesoamericana Project. *Plinia* is a Neotropical genus of shrubs and small trees, occurring from Brazil and Peru north to the West Indies and Cuba, and westward to Panama, Costa Rica, Nicaragua, and Belize. The genus is characterized by flowers with the hypanthium prolonged beyond the summit of the ovary, a calyx fused and nearly closed in bud that splits at anthesis into four irregular lobes, and a bilocular ovary with two locules per ovule. The fruit is a single- or several-seeded berry; the seeds have a papery coat enclosing an embryo with two large, plano-convex cotyledons and a reduced, indistinct hypocotyl. The fleshy fruits place *Plinia* in Myrtaceae tribe Myrteae, along with nearly all New World Myrtaceae; the embryo characters place it in the subtribe Eugeniinae (McVaugh, 1968; Landrum & Kawasaki, 1997).

Recent estimates of the number of species in *Plinia* have ranged from as few as 6 (Sánchez Vindas, 2001) to approximately 30 (McVaugh, 1989). The newly described taxa presented here raise the estimate to ca. 40 species. The nearly seven-fold difference is indicative of the confusion as to what, exactly, constitutes a *Plinia*. The core group of species in *Plinia*, including all known Mesoamerican taxa, shares with the type species, *P. pinnata* L., the character of sessile or subsessile flowers grouped in cauliflorous, glomerate inflorescences that are subtended by up to 10 pairs of prominent, decussate bracts superficially resembling an involucre (McVaugh, 1968). However, several authors have increased the number of included species by weighting certain floral characters and discounting inflorescence structure. Kausel (1956) transferred three species from *Myrciaria* (*M. cauliflora*, *M. jaboticaba*, and *M. trunciflora*) solely on a single character of the embryo, the presence of separate, plano-convex cotyledons. But in at least one of these species, *Myrciaria cauliflora* (Martius) O. Berg, the flowers have a tubular hypanthium, circumcissile at the base and falling as a unit with the perianth and androecium after anthesis (M. L. Kawasaki, pers. comm.). This character is common to all *Myrciaria*, but is otherwise unknown in *Plinia*. McVaugh (1958, 1963) referred to *Plinia* any eugenioid species with floral characters as described above. Included were species with axillary, racemose inflorescences and pedicellate flowers (e.g., *Plinia clausa* McVaugh).

Kausel and/or McVaugh have been followed by some subsequent authors (e.g., Rotman, 1982; Sobral, 1993; Kawasaki & Holst, 2002), though with varying degrees of enthusiasm. Landrum and Kawasaki (1997: 532) described *Plinia* as "an arbitrarily defined group." McVaugh himself considered it a "heterogeneous assemblage" (1963: 507); his inclusion of the racemose taxa was provisional, pending reevaluation when better data on the generic limits became available. The confusion is not unique to *Plinia*, but indicative of the current unsettled state of generic concepts in the Eugeniinae. The issue will not be satisfactorily resolved until a comprehensive analysis of the subtribe is performed.

The Mesoamerican species of *Plinia* are shrubs

or small trees, 10 m or shorter, of evergreen lowland and montane forests and cloud forests. All have the floral and inflorescence characters of the *Plinia* "core group." The bark is smooth, white, gray, or brown, and exfoliates in plates. Vestiture is composed of straight or recurved, simple trichomes, 0.5–3 mm long, and is quite dense on young growth.

The branchlets are weakly to strongly compressed near the outermost nodes. They are bilaterally channeled between the two outermost nodes in *Plinia guanacastensis*, *P. nicaraguensis*, and *P. panamensis*. Young growth is sericeous or velutinous, the trichomes are simple, 0.5–3 mm long, erect or recurved, and typically white or golden-brown. The vestiture thins but persists with age.

Unlike *Eugenia*, where terminal, vegetative buds tend to be rather uniform and unremarkable, in *Plinia* they often have species-specific characters. The buds are ovate to broadly ovate, up to 1 cm long, and protected by 8 to 14 ovate to broadly ovate, imbricate scales, which vary among species in size, shape, and vestiture. When a bud breaks, the inner scales tend to enlarge and change shape. However, the outer 2 to 4 scales retain their conformation and, when present, are often useful for identification. The most significant characters of the scales are general shape, whether or not the back is carinate, the shape of the apex, whether rounded, acute, or acuminate, and whether or not the margins are scarious or ciliate. The form of the inflorescence bracts often approximates that of the vegetative bud scales.

The leaves in *Plinia* are petiolate. The blades are narrowly elliptic or lanceolate to elliptic or ovate. Emergent leaves are commonly sericeous or arachnoid, densely covered with simple, white trichomes up to 3 mm long. This covering is soon lost; in mature leaves the vestiture is thinner, usually composed of trichomes shorter than 1 mm and often restricted to the midvein or to one side of the leaf. Venation is brochidodromous; the submarginal vein formed by the lateral veins as they curve to meet the next succeeding lateral vein may be prominently looped if the lateral veins are few and rather remote from the margin, as in *P. salticola* McVaugh, or it may appear straight if it is close to the margin or if the lateral veins are numerous, as in *P. panamensis*. The veins may be weakly convex or flush with the surface of the blade (e.g., *P. darienensis*) or moderately to deeply impressed in the upper surface (e.g., *P. panamensis*). Leaf bases, typically cuneate, are cordate in *P. panamensis* and subcordate to abruptly truncate in *P. cerrocampanensis*. Excepting *P. gentryi*, which has acute or acuminate, bluntly tipped leaves, leaf apices are acuminate to caudate, with a sharply pointed tip. Petioles are terete or flattened dorsally, with pubescence that tends to match the branch to which it is attached more than it does the blade.

The glomerate inflorescences are borne on the trunks and larger branches. The bracts subtending the inflorescence are persistent and conspicuous in flower, though at times obscured by mature fruit. The identifying characters are similar to those of the vegetative bud scales: shape, apices, margins, and vestiture. The 2 to 10 flowers are sessile, borne in pairs, and subtended by a pair of bracteoles that are similar to the bracts.

The flowers are 4-merous, with the hypanthium prolonged into a tube above the summit of the ovary. The size and shape of the hypanthium, the degree to which it is ribbed, and vestiture type provide useful, species-level characters. The calyx is fused and nearly closed in bud, the tips of the calyx lobes outlining a terminal pore. At anthesis, the calyx tears irregularly into 4 lobes and reflexes. The petals are caducous and rarely found in herbarium collections. They are white with irregular margins and, in the few specimens seen, pubescent on both surfaces. The stamens are numerous, borne in a ring at the base of the calyx lobes that is presented as the calyx reflexes. Like the petals, the stamens are apparently quickly lost and infrequently seen in specimens. The ovary is 2-loculed, with 2 ovules per locule. The single style is glabrous.

The fruit is a weakly to strongly compressed berry, usually single-seeded, 3–12 cm in diameter. The pericarp is succulent when ripe, yellow or orange with a sweet odor. Ribbing may be present or absent. The membranous seed coat surrounds the embryo of a reduced hypocotyl and two massive, separate, plano-convex cotyledons. In some species the embryo is purple or reddish purple.

Plinia L., Sp. Pl. 516. 1753. TYPE: *Plinia pinnata* L.

KEY TO THE MESOAMERICAN SPECIES OF *PLINIA*

1a. Leaves 5.5–10 cm long.
  2a. Leaves elliptic or oblong, coriaceous.
    3a. Lateral veins 10 to 14 per side, the leaf apex acute or acuminate, the tip 1–5 mm, blunt or rounded . . . . . 5. *P. gentryi*
    3b. Lateral veins 16 to 22 per side, the leaf apex acuminate or caudate, the tip 10–25 mm, sharply pointed . . . . . 13. *P. salamancana*
  2b. Leaves lanceolate or narrowly elliptic, chartaceous.

4a. Lateral veins 14 to 15 per side; fruits lenticular . . . . . 2. *P. coclensis*
4b. Lateral veins 15 to 25 per side; fruits oblate or subglobose . . . . . 12. *P. puriscalensis*

1b. Leaves 9–40 cm long.
5a. Lateral veins 20 or more per side.
6a. Leaf base cordate . . . 9. *P. panamensis*
6b. Leaf base cuneate.
7a. Lateral veins inscribed or impressed in the upper leaf surface . . . . . 11. *P. povedae*
7b. Lateral veins flat or slightly convex . . . . . 4. *P. darienensis*

5b. Lateral veins fewer than 20 per side.
8a. Lateral veins flat or slightly convex on both surfaces; not prominent.
9a. Lateral veins 6 to 10 per side . . . . . 14. *P. salticola*
9b. Lateral veins 12 to 18 per side.
10a. Leaf blades 9–12 cm, the petioles 5–10 mm; Belize . . . . 10. *P. peroblata*
10b. Leaf blades 9–21 cm, the petioles 15–20 mm; Costa Rica . . 7. *P. moralesii*
8b. Lateral veins inscribed in the upper leaf surface, prominent on the lower leaf surface.
11a. Leaf tips 15–20 mm.
12a. Glands on the lower leaf surface numerous, red or brown, distinct . . . . . 1. *P. cerrocampanensis*
12b. Glands on the lower leaf surface numerous, concolorous and indistinct . . . . . 6. *P. guanacastensis*
11b. Leaf tips 20–40 mm.
13a. Leaf tips 20–30 mm; petioles 12–20 mm . . . . . 8. *P. nicaraguensis*
13b. Leaf tips 30–40 mm; petioles 8–10 mm . . . . . 3. *P. cuspidata*

1. Plinia cerrocampanensis Barrie, sp. nov. TYPE: Panama. Panamá: Cerro Campana, 800–1000 m, 3 Apr. 1972, *A. Gentry 4944* (holotype, MO; isotype, F). Figure 1.

Species haec a *Plinia cuspidata* foliis laminis basibus cordatis vel truncatis et apicibus brevioribus differt.

Shrubs or trees to ca. 6 m; young growth velutinous, the trichomes 2–3 mm, coarse, coppery at first, turning white, branchlets compressed below the terminal node, the bark red, velutinous, ultimately white, glabrate; outer scales of the vegetative buds 3–6 × 2–3 mm, ovate, carinate dorsally, pubescent, the margins scarious-ciliate, the apex acuminate or apiculate. Leaves narrowly elliptic or elliptic, the blades 10–20 × 3.5–6.5 cm, 2.5–3.7 times as long as wide; chartaceous; drying green above, paler green or yellow below, the veins commonly red or brown on the lower surface; midvein flat or convex on both surfaces; lateral veins 10 to 14 per side, inscribed in the upper surface, prominent on the lower surface; submarginal veins similar to the laterals and arched between them, 2–3 mm from the margins; surfaces of young leaves sericeous or arachnoid, the trichomes 2–3 mm, slender, white, the upper surface ultimately glabrate or with a few persistent trichomes, often near the base, the midvein puberulent, the lateral veins glabrate, the lower surface persistently pubescent, the trichomes ca. 2 mm, contorted, the midvein and lateral veins puberulent; glands numerous and small, red or brown on the lower surface; base subcordate or abruptly truncate; margins entire; apex abruptly acuminate, the tip 15–20 mm, sharply pointed; petioles 10–15 mm, terete or flattened dorsally, coarsely puberulent, the vestiture similar to the branchlets. Inflorescence cauliflorous, sessile, flowers ca. 8; bracts 2–5 × 1.5–3 mm, ovate, the back carinate, the base rounded, tomentose, the margins scarious-ciliate, the apex acuminate, paired in ca. 4 decussate ranks; buds 8–10 mm, pyriform, the ovary tomentose, the trichomes ca. 2 mm, white, the calyx glabrous, glandular, the pore 1–2 mm diam., the tips of the calyx lobes ciliate. Flowers sessile; bracteoles ca. 6 × 2 mm, lanceolate, the outer surface tomentose, the base rounded, the margins scarious-ciliate, the apex acuminate; hypanthium campanulate, the tube extending 2–3 mm beyond the summit of the ovary, the throat glabrous, ca. 4 mm diam. at the base of the staminal ring; calyx lobes 2–3 × 2–3 mm, oblong or obovate, both surfaces glabrous, the apex broadly acute, ciliate; petals 3–4 × 2.5–3 mm, obovate, white, both surfaces puberulent, the trichomes ca. 0.1 mm, the margins and apex irregular, ciliate; stamens ca. 200, 5–7 mm; style ca. 10 mm. Fruits 30–50 × 40–60 mm, oblate or turbinate; pericarp fleshy with numerous, indistinct, vertical ridges, sparsely pubescent; mature color yellow or orange.

Habitat, distribution, and phenology. Ridge-top cloud forests and adjacent Atlantic slope montane wet forests in the Parque Nacional Altos de Campana, Panama, 700–1000 m. Collected in flower May to July; collected in fruit March to May.

Plinia cerrocampanensis is distinguished by the carinate bud scales and inflorescence bracts with acuminate to apiculate apices and the narrowly elliptic leaves, 10–20 cm long, with subcordate or abruptly truncate bases and numerous, small red glands on the lower surface. The other Panamanian

Figure 1. *Plinia cerrocampanensis* Barrie (*Gentry 4944*; holotype, MO).

species with cordate leaf bases, *P. panamensis*, has broader and typically much longer leaves (14–30 cm) with numerous, deeply inscribed lateral veins.

The ovate, dorsally carinate bracts with acuminate apices are similar in shape, though about twice the size, to those of *P. cuspidata* Gómez-Laurito & Valverde. The two may be distinguished by several leaf characters, among them the apices, which are caudate-aristate in *P. cuspidata*, with the acumen 30–40 mm long. The leaf bases are cuneate, and

the glands on the undersurface are green or clear, not red. This is one of three Panamanian species, the others being *P. coclensis* and *P. gentryi*, that occur in isolated patches of low-elevation cloud forests along the Continental Divide. These habitats are known to be rich in endemics (Myers, 1969; Lewis, 1971).

Paratypes. PANAMA. **Panamá:** Cerro Campana, *Busey 848* (MO); P. N. Altos de Campana, sendero del Tigre, *Correa A. & Montenegro 9543* (F), *Espinosa et al. 709* (F), *Galdames 745* (F), *Galdames et al. 4318* (MO); Sendero de Interpretación, 1 km al E del Campamento de los guardabosques de INRENARE, *Correa A. & Montenegro 9623* (F), *Galdames 1106* (F); Recorrido por el sendero a un costado del Camino Zamora, *Correa A. & Montenegro 11150* (F); Cordillera del Llorón, *Galdames et al. 3796* (F, MO); upper slopes of Cerro Campana within the boundary of the national park administered by RE-NARE, *LeDoux 2578* (MO).

2. Plinia coclensis Barrie, sp. nov. TYPE: Panama. Coclé: summit at Alto Calvario, low montane cloud forest, ridge-type vegetation, 4 Apr. 1977, *J. P. Folsom & R. Robinson 2399* (holotype, MO; isotypes, F, MO). Figure 2.

Pliniam puriscalensem aemulans, sed foliis nervis paucioribus et fructibus lenticularibus differt.

Shrubs or trees, 1.5–5 m; young growth sericeous, the trichomes white, 1–2 mm. Branchlets slender, weakly compressed at the upper nodes; bark red, smooth, ultimately glabrate or with a few persistent trichomes; the outer scales of the vegetative buds broadly ovate, 1–2 × 1–2 mm, the back carinate, glabrous, the margins ciliate, the apex acute. Leaves narrowly elliptic or lanceolate, the blades 5.5–8 × 1.5–2.2 cm, 3–4.4 times as long as wide; chartaceous; drying a concolorous green; midvein flat or convex on the upper surface, convex on the lower surface; lateral veins 14 to 15 per side, obscure on one or both surfaces of mature leaves; submarginal veins similar to the laterals and weakly arched between them, ca. 2 mm from the margins; the upper and lower surfaces glabrate or persistently puberulent near the base of the midvein; glands minute, obscure on mature leaves; base cuneate; margins cartilaginous; apex caudate, the tip 15–25 mm; petioles 8–10 mm, puberulent, ultimately glabrate; terete or weakly compressed dorsally. Inflorescences, flowers, and attached fruits not seen. Fruits 10–20 × 20–40 mm, lenticular; pericarp fleshy, obscurely ribbed, glabrous; mature color unknown.

Habitat, distribution, and phenology. Wet forests, Pacific Slope, Coclé Province, Panama, 400–900 m. Collected in fruit January to April.

Plinia coclensis is distinguished by the carinate, broadly ovate bud scales with acute apices, the narrowly elliptic leaves with cuneate bases, and strongly lenticular fruits that are obscurely ribbed and glabrous. The leaves are similar in size and shape to those of the Costa Rican species *P. puriscalensis* P. E. Sánchez & Q. Jiménez, which has oblate or subglobose, rather than lenticular, fruits.

Paratypes. PANAMA. **Coclé:** Coclecito Road, transection from 1 mi. beyond divide to ridge top, *de Nevers et al. 6746* (F, MO); 7 km N of Llano Grande on road to Coclesito, *Hammel 1944* (MO).

3. Plinia cuspidata Gómez-Laurito & Valverde, Lankesteriana 3: 11. 2002. TYPE: Costa Rica. Limón: Talamanca, Bratsi, Buena Vista, Finca ACODEFO, 25 Nov. 2000, *O. Valverde & S. Mora 1339* (holotype, USJ).

Illustration. Gómez-Laurito & Valverde, Lankesteriana 3: 12; f. 1. 2002.

Shrubs or trees, to 15 m; young growth sericeous, the trichomes 1–3 mm, white. Branchlets compressed and bilaterally grooved immediately below the terminal nodes; bark reddish brown, villosulous, the trichomes 0.3–0.5 mm, straight and recurved, brown, ultimately sordid; outer scales of the vegetative bracts 1–3 × 1–1.5 mm, ovate, carinate, appressed-pubescent on the outer surface, the margins scarious, the apex acuminate. Leaves elliptic, the blades 13–23 × 5–10 cm, 2–3 times as long as wide, chartaceous, drying a concolorous green; midvein convex between two parallel grooves on the upper surface, prominent on the lower surface; lateral veins 14 to 18 per side, shallowly to deeply inscribed in the upper surface, prominent on the lower surface; submarginal veins similar to the laterals and weakly arched between them, 4–5 mm from the margins; the upper surface ultimately glabrate, the midvein glabrate or persistently pubescent, the trichomes erect or recurved, ca. 2 mm, the lower surface persistently but sparsely pubescent, the trichomes 0.3–0.5 mm, the midvein and lateral veins pubescent to tomentose; glands numerous on both surfaces, obscure above on mature leaves; base cuneate to obtuse or rounded; margins planate; apex abruptly caudate acuminate, the tip 30–40 mm, sharply pointed; petioles 8–10 mm, villosulous, similar to the branchlets, terete. Inflorescences cauliflorous, sessile, flowers 4 to 10; bracts 1.5–3.5 × 1.5–3 mm, lanceolate to ovate, sparsely pubescent to tomentose on the outer surface, the margins scarious-ciliate, the apex acute, paired in 4 decussate ranks; buds 9–10 mm, pyriform, tomentose, the pore 1–2 mm across. Flowers sessile;

Figure 2. *Plinia coclensis* Barrie (*Folsom & Robinson 2399*; holotype, MO).

bracteoles ca. 2 × 1 mm, lanceolate or ovate, tomentose, the margins scarious-ciliate, the apex acute or acuminate; hypanthium campanulate, ca. 7 mm, the tube extending 3–4 mm beyond the summit of the ovary, the ovary and tube tomentose, the trichomes ca. 1 mm, white; calyx lobes ca. 4 × 4 mm, oblong, tomentose without, villosulous within, the margins irregular, the apex rounded; petals white, both surfaces puberulent, the trichomes ca. 0.1 mm; stamens ca. 130; style 3–4 mm. Fruits 30

× 35–40 mm, oblate or lenticular; pericarp fleshy, smooth, yellow at maturity; calyx persistent, reduced, the lobes deciduous.

Habitat, distribution, and phenology. Wet forests, Atlantic slope, from central Panama to central Costa Rica, 0–900 m. Collected in flower in July; collected in fruit February to April.

Plinia cuspidata is distinguished by the carinate vegetative bud scales with acuminate apices, leaf blades with 14 to 18 lateral veins per side and abruptly caudate-acuminate apices 30–40 mm long, and oblate or lenticular, smooth fruits. Many of the specimens examined were originally identified as *P. povedae*, the leaves of which tend to be narrower, with 20 to 40 lateral veins per side and the leaf apex less abruptly acuminate. The fruits of *P. povadae* are costate and typically have 6 to 8 prominent ribs.

Additional specimens examined. COSTA RICA. **Cartago:** Moravia de Turrialba, *Poveda 960* (CR, F). **Limón:** Guápiles, Los Angeles, San Miguel, *Herrera & Schik 3798* (F, MO); Est. Carillo, Sendero a las tomas de agua, Cerro Coronel, E of Laguna Danto, *Stevens 23805* (MO); Cerro Coronel, E of Río Zapote, E of new road to Raphia swamp, within 1 km of Río Colorado, *Stevens et al. 24675* (F). **Puntarenas:** Osa, Sierpe, Boca Ganado, Fila Ganado, *Herrera et al. 6657* (CR, F); Osa, Bajando Cerro Brujo hacia el oeste, Sierpe, *Marín & Trejos Ureña 329* (INB, MO). **San José:** P. N. Braulio Carillo, Est. Carillo, *Sánchez V. 566* (CR). PANAMA. **Bocas del Toro:** Siguiendo el camino que va a Quebrada Bonyic, *Santamaría & Lara 1091* (F). **Coclé:** vic. La Mesa, bey. El Valle, on N slope of Cerro Gaital, *McPherson 11222* (F). **Panamá:** Capira, NE side of Cerro Trinidad, *Foster 2111* (MO).

4. Plinia darienensis Barrie, sp. nov. TYPE: Panama. Darién: Río Pirre, old forest 10 mi. S of El Real near "Dos Bocas," 2 Apr. 1971, *R. Foster & T. Lowenbach 2271* (holotype, MO; isotypes, F, MICH). Figure 3.

Pliniae panamensi similis, sed foliis laminis basibus cuneatis et venis lateralibus et submarginalibus convexis vel planis differt.

Shrubs or trees to ca. 7 m; young growth sericeous, the trichomes 2–4 mm, coarse, coppery branchlets weakly compressed; bark brown, flaking, densely to sparsely pubescent, the trichomes ca. 0.2 mm, straight or recurved; outer scales on vegetative buds 3–5 × 5–8 mm, depressed ovate, densely appressed pubescent, the margins undulate, scarious-ciliate, the apex rounded. Leaves narrowly elliptic, the blades 14–40 × 6–8 cm, 3–5.5 times as long as wide; coriaceous; midvein flat or concave on the upper surface, prominent on the lower surface; lateral veins 20 to 35 per side, flat or slightly convex; submarginal veins similar to the laterals and arched between them, 1–2 mm from the margins; the upper surface ultimately glabrate, the midvein persistently sericeous or hispidulous, the trichomes ca. 0.1 mm, erect, the lower surface glabrate or with a few persistent trichomes near the base, the midvein hispidulous, the trichomes ca. 0.2 mm; glands numerous and minute on both surfaces or obscure above; base cuneate; margins revolute near base; apex acuminate or caudate, the tip 15 mm, sharply pointed; petioles 10–15 mm, densely puberulent, similar to the branchlets, terete. Inflorescence cauliflorous, sessile; flowers 2 to 4; bracts ca. 2 × 2 mm, ovate, the outer surface tomentose, the inner surface with scattered trichomes, the margins undulate, irregular, scarious, the apex rounded, paired in 2 to 4 decussate ranks; buds 12–15 mm, pyriform, the base tomentose, the tube and calyx sparsely pubescent. Flowers sessile; bracteoles ca. 2 × 2 mm, similar to the bracts, ovate, the outer surface tomentose, the inner surface with scattered trichomes, the margins undulate, irregular, scarious, the apex rounded; hypanthium campanulate, the tube elongate 3–5 mm beyond the summit of the ovary, 6–8 mm diam. at the base of the staminal ring, the base tomentose, the tube and the outer surface of the calyx lobes glabrate; calyx lobes ca. 9 × 7.5 mm, oblong, pubescent on the inner surface, the margins irregular, the apex rounded; petals not seen; stamens ca. 400; style ca. 18 mm. Fruits 65–80 mm diam., oblate, the calyx lobes and tube persistent; pericarp fleshy, 4 to 8 prominent ribs plus numerous indistinct intermediates, sparsely pubescent; mature color orange or yellow.

Habitat, distribution, and phenology. Wet forests, Darién Province, Panama, 300 m. Collected in flower and fruit October to April.

Plinia darienensis is characterized by narrowly elliptic leaves with blades 14–40 cm long, with lateral and submarginal veins that are flat or nearly so on both surfaces. In the other large-leaved Panamanian species, *P. panamensis* and *P. povedae*, the lateral veins are inscribed. *Plinia panamensis* differs also in having cordate leaf bases. The outer bud scales are broader than long with undulate, scarious-ciliate margins. The fruits are similar in appearance to those of *P. panamensis*, though possibly somewhat smaller. Fruits of the latter with diameters of 120 mm have been seen, but, as the measurements for *P. darienensis* are based on only two collections and five fruits, it may be that the apparent size difference is an artifact of inadequate sampling.

Paratypes. PANAMA. **Darién:** La Boca de Pirre,

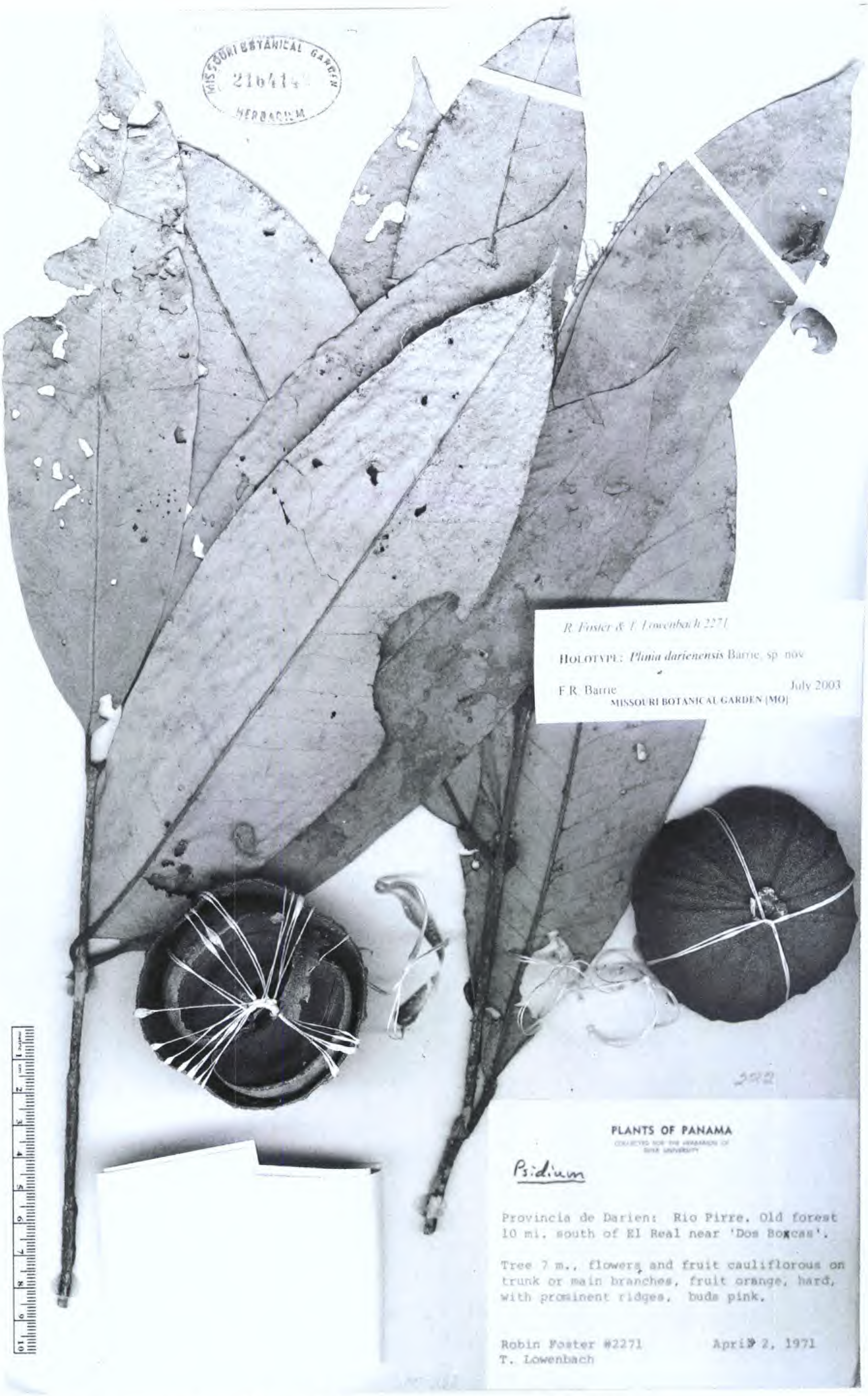

Figure 3. *Plinia darienensis* Barrie (*Foster & Lowenbach 2271*; holotype, MO).

Bristan 1247 (MO); Camino del Pirre, *Duke & Bristan 258* (MO); Cerro Pirre, valley betw. Pirre & next most southerly peak, *Folsom 4391* (MO); ca. 3 mi. SE of Pijibasal, ca. 9 mi. S of El Real, vic. of confluence of Dos Bocas & Río Pirre, *Hartman 12011* (F, MO).

5. **Plinia gentryi** Barrie, sp. nov. TYPE: Panama. Panamá: near top of Cerro Jefe to 1 mi. beyond, 1 Jan. 1972, *A. Gentry 3448* (holotype, MO). Figure 4.

Figure 4. *Plinia gentryi* Barrie (*Gentry 3448*; holotype, MO).

A *Plinia salamancana* foliis nervis paucioribus, apicibus brevioribus et petiolis longioribus differt.

Trees ca. 5 m; young growth coarsely tomentose, the trichomes 1–3 mm; branchlets compressed at the outer nodes; bark reddish, puberulent, the trichomes ca. 0.2 mm, contorted, ultimately glabrate; outer scales of the vegetative buds ca. 1 × 1 mm, broadly ovate, the margins rounded, ciliate, the scales otherwise glabrous. Leaves elliptic, the blades 3.5–7.5 × 1.5–4 cm, 1.7–2.5 times as long

as wide; coriaceous; midvein convex or flat on the upper surface, convex on the lower surface; lateral veins 10 to 14 per side, often obscure above on mature leaves, convex below; submarginal veins similar to the laterals and arched between them, 1–2 mm from the margins; both surfaces glabrate or with a few persistent trichomes near the base, the midvein glabrate or persistently puberulent above, persistently puberulent below, the trichomes ca. 0.2 mm; glands numerous, minute and punctate on the upper surface, scattered on the lower surface; base obtuse; margins revolute; apex acute or abruptly acuminate, the tip 1–5 mm, blunt or rounded; petioles 8–15 mm, puberulent, the vestiture similar to the branchlets, ultimately glabrate, terete or somewhat flattened dorsally. Inflorescence cauline, flowers not seen, apparently 4; bracts not seen; attached fruits not seen. Fruits 15–25 × 25–35 mm, oblate; pericarp fleshy, rugulose, pubescent, more densely near the apex; calyx deciduous in ripe fruit, leaving a terminal, circular scar; mature color not known.

Habitat, distribution, and phenology. Apparently endemic to the cloud forest area on Cerro Jefé, Panama, 900 m. Collected in fruit in January.

Apparently restricted to the narrow band of cloud forest along the ridge of the Continental Divide on Cerro Jefé, *Plinia gentryi* is most similar to *P. salamancana* (Standley) Barrie, which grows in the wet montane forests at lower elevations. The two may be readily distinguished by leaves alone. The leaf blades of *P. gentryi* tend to be shorter (3.5–7.5 cm long vs. 6–10 cm in *P. salamancana*) and broader (1.7–2.5 times as long as wide vs. 2.5–2.8 in *P. salamancana*), with shorter apices (1–5 mm vs. 15–25 mm). The ultimate leaf tip is blunt or rounded, rather than sharply pointed, as is the case in *P. salamancana*. In both species, in mature leaves the lateral veins are obscure on the upper surface, which is dotted with numerous, minute, punctate glands.

Etymology. Named in honor of the late, noted tropical botanist Al Gentry, who collected the type of this species, as well as that of *P. cerrocampanensis*.

Paratypes. PANAMA. **Panamá:** Cerro Jefe, *Duke 9468* (MO); near top of Cerro Jefé to 1 mi. beyond, *Gentry et al. 3471* (MICH, MO).

6. Plinia guanacastensis Barrie, sp. nov. TYPE: Costa Rica. Guanacaste: P. N. Guanacaste, Cord. de Guanacaste, Cerro Cacao, Est. Cacao, 10 Mar. 1991, *C. Chávez 512* (holotype, INB; isotypes CR, F). Figure 5.

Species haec a *Plinia salticola* plus venis lateralibus foliis et fructibus immaturis puberulis differt.

Trees to ca. 12 m; emergent growth sericeous, the trichomes 1–2 mm, white; branchlets compressed, bilaterally channeled below the terminal nodes, the bark reddish, puberulent, the trichomes ca. 0.1 mm; outer scales of vegetative bracts ca. 1 × 1 mm, widely ovate, the margins scarious, the apex rounded or mucronate. Leaves narrowly elliptic or elliptic, the blades 12–16 × 4–6 cm, 2.7–3.5 times as long as wide; chartaceous; drying a concolorous green or paler on the lower surface; midvein flat or convex on the upper surface, prominent on the lower surface; lateral veins 10 to 18 per side, inscribed in the upper surface, prominent on the lower surface; submarginal veins similar to the laterals and arched between them, 4–5 mm from the margins; the upper surface persistently pubescent along the midvein and the lateral veins, otherwise glabrate, the lower surface with a few persistent trichomes, the midvein sericeous, the trichomes 1–2 mm, the lateral veins puberulent; glands numerous, obscure above on mature leaves; base cuneate; margins revolute near the base; apex caudate-acuminate, the tip 15–20 mm, sharply pointed; petioles 10–15 mm, puberulent, similar to the branchlets, terete. Inflorescence cauliflorous, sessile; flowers 2 to 8; bracts 1–2 × 1–2 mm, semicircular, convex, a few trichomes on the outer surface, the margins ciliate, the apex rounded, paired in 2 to 4 decussate ranks of decreasing size; buds not seen. Flowers and mature fruits not seen. Immature fruits ca. 2 cm, obconic, sessile, constricted below the remnants of the calyx, puberulent, the trichomes white or golden, ca. 0.1 mm; calyx lobes deciduous, the tube persistent, forming a crown ca. 3 × 2 mm on the developing fruit.

Habitat, distribution, and phenology. Montane wet forests in the Cordillera de Guanacaste, Costa Rica, 800–1000 m. Collected in flower in August; collected in fruit February to March.

The developing fruits of *Plinia guanacastensis* are similar to those of *P. salticola* McVaugh, but are puberulent rather than glabrous or nearly so. While the leaf blades of both species are approximately the same length, 12–16 cm here, 9–17 cm in *P. salticola*, the leaves of *P. guanacastensis* tend to be narrower, 2.7–3.5 times as long as wide versus a ratio of 2–3:1 in *P. salticola*, with about twice as many lateral veins, 10 to 18 versus 6 to 10 per side, which are inscribed, rather than flat or convex, as in *P. salticola*.

Paratypes. COSTA RICA. **Guanacaste:** Liberia, P. N. Guanacaste, Cord. de Guanacaste, Est. Cacao, Sendero a

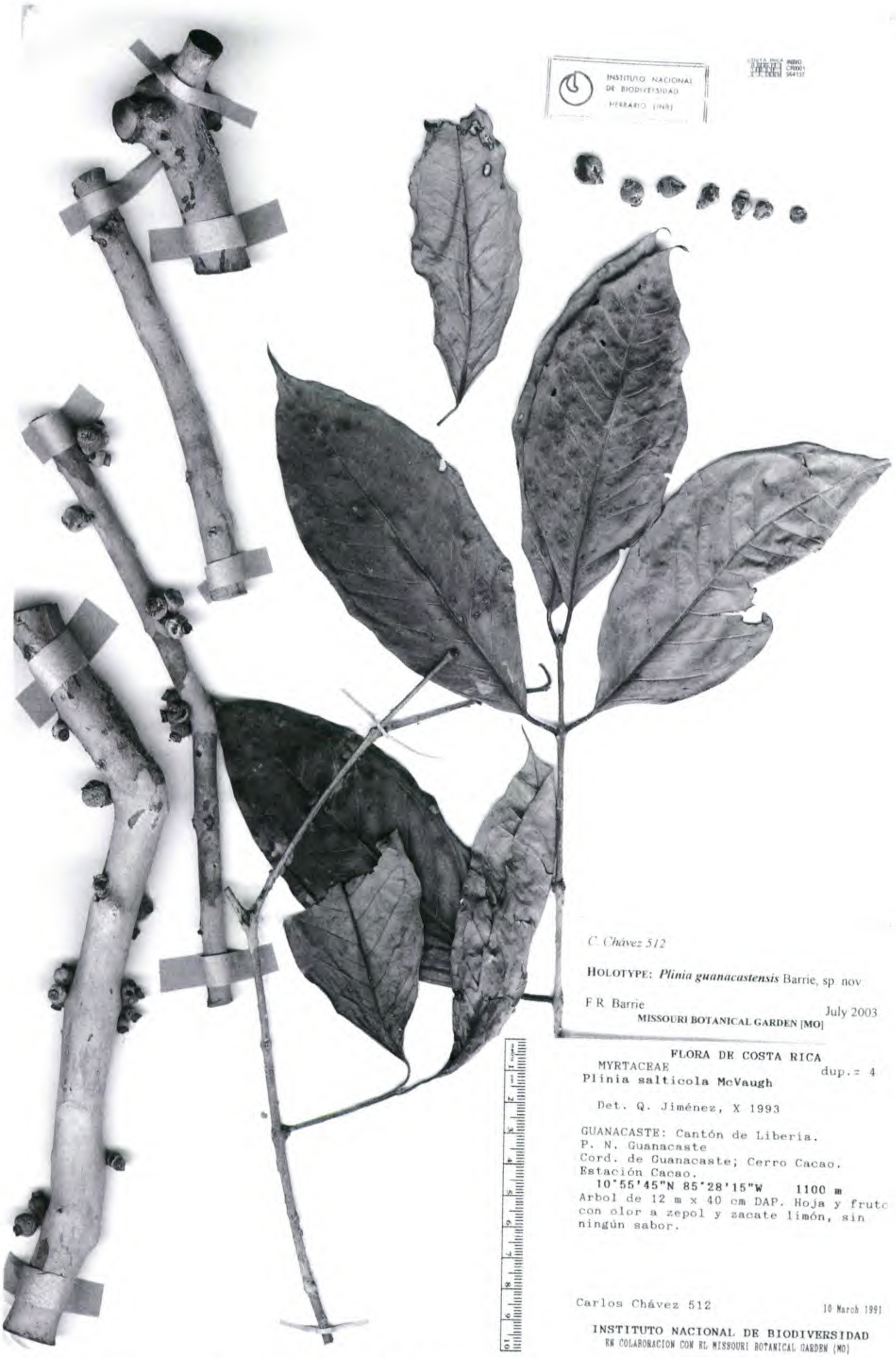

Figure 5. *Plinia guanacastensis* Barrie (*Chávez 512*; holotype, INB).

casa de Fran, *Angulo et al. 35* (CR, F, INB, MO); Sendero Arenal, *Gamboa 57* (CR, INB); Sendero a la Cima, *Rodríguez et al. 3112* (INB); Tilarán, Cordillera de Tilarán, 1–2 km W of Lago de Cote, 13 km N of Tilarán, Continental Divide on SE slope of Volcán Tenorio, Eco-Lodge, *Haber & Zuchowski 11646* (INB).

7. **Plinia moralesii** Barrie, sp. nov. TYPE: Costa Rica. San José: Fila Bustamante, Hda. Tiquires, Los Ayarales, 3 June 1995, *J. F. Morales 4316* (holotype, INB; isotypes, F, MO). Figure 6.

Figure 6. *Plinia moralesii* Barrie (*Morales 4316*; holotype, INB).

Species haec a *Plinia salticola* plus venis lateralibus foliis, petiolis longioribus et hypanthiis costatis et tomentosis differt.

Shrubs or trees to 5 m; young growth sericeous, the trichomes white, 2–3 mm; branchlets compressed; bark red, soon turning white, smooth, coarsely puberulent, the trichomes ca. 0.2 mm, straight and recurved, ultimately glabrate; outer scales of the vegetative buds 2–3 × 2–3 mm, widely ovate, convex, a few scattered trichomes on the

outer surface, the margins scarious-ciliolate, the apex acute. Leaves narrowly elliptic, the blades 9–21 × 3–6 cm, 3–4.5 times as long as wide; chartaceous; midvein flat on the upper surface, convex on the lower surface; lateral veins 12 to 18 per side, flat or slightly convex; submarginal veins similar to the laterals and arched between them, 3–5 mm from the margins; the upper surface glabrate, the lower surface glabrate or with a few persistent trichomes near the base, the midvein puberulent on both surfaces, the trichomes ca. 0.2 mm, straight or recurved; glands obscure above on mature leaves, scattered, dark below; base cuneate, margins recurved near the petiole; apex tapering from the middle, then abruptly acuminate, the tip ca. 15 mm, sharply pointed; petioles 15–20 mm, coarsely puberulent, similar to the branchlets, ultimately glabrate, terete or depressed dorsally. Inflorescences cauliflorous, sessile, flowers 4 to 8; bracts 3–10 × 5–6 mm, ovate, the outer surface sericeous, the margins scarious, the apex acute or acuminate, paired in 2 to 4 decussate ranks of decreasing size; buds not seen. Flowers sessile; bracteoles ca. 3 2 mm, ovate, the outer surface sericeous, the margins scarious, the apex acute or acuminate; hypanthium 10–15 mm, campanulate, uniformly tomentose, the trichomes white, 1–2 mm, the base prominently ridged, the tube extending 4–5 mm beyond the summit of the ovary, ca. 8 mm diam. at the staminal ring; calyx lobes 5 × 4–7 mm, broadly ovate to oblong, sericeous on the inner and outer surfaces, the margins irregular, the apex truncate or rounded; petals, stamens, and style not seen. Fruit 30–40 mm diam., globose or subglobose, the pericarp fleshy, costate with numerous, prominent, anastamosing ridges; calyx tube persistent, the lobes deciduous; mature color unknown.

Habitat, distribution, and phenology. Montane wet forests, central Costa Rica, 1000–2200 m. Collected in flower and fruit March to July.

Compared to the leaves of *Plinia salticola*, the leaf blades in *P. moralesii* are similar in length but narrowly elliptic, with longer petioles, 15–20 mm versus 6–13 mm, and more numerous lateral veins, 12 to 18 versus 6 to 10 per side. The leaves are generally narrower than those of *P. guanacastensis*, which also has shorter petioles, 10–15 mm, and longer leaf tips (15–20 mm), but the same number of lateral veins. The hypanthium of *P. moralesii* is tomentose and strongly ribbed, and the immature fruits, at least, are costate, with numerous, prominent, anastamosing ridges. Fully mature fruits were not seen. This is the only Central American *Plinia* occurring consistently above 1000 m.

Etymology. Named in honor of the collector of the type, José Francisco Morales, the author of numerous contributions on the Costa Rican flora.

Paratypes. COSTA RICA. **Alajuela:** San Ramón, Valle Escondido, Finca Aeropecuaria Peyra, sendero dentro del bosque, *Jiménez et al. 1302* (INB, MO). **San José:** Acosta, Fila Bustamante, Hacienda Tiquires, Los Ayarales, *Morales 4339* (F, INB, MO); Tiquires, *Valerio 1681* (F); Zona Protectora Cerros de Escazú, Río Negro entrando por Palmichal, *Vargas & Sánchez V. 974* (CR).

8. Plinia nicaraguensis Barrie, sp. nov. TYPE: Nicaragua. Atlántico Sur: Atlanta, Caño el Tigrillo (La Picada), 8 Nov. 1982, *A. Laguna 156* (holotype, MO). Figure 7.

A *Plinia povedae* foliis laminis brevioribus, venis lateralibus paucioribus et petiolis longioribus differt.

Trees to ca. 7 m; young growth not seen; branchlets compressed, bilaterally channeled below the terminal node, densely puberulent, the trichomes ca. 0.2 mm, straight or recurved; outer scales of vegetative buds ca. 1–2 × 3 mm, broadly depressed ovate, puberulent on the outer surface, the margins scarious-ciliolate, the apex rounded. Leaves ovate or elliptic, the blades 17–28 × 6–11 cm, 2.5–3 times as long as wide; chartaceous; midvein depressed on the upper surface, prominent on the lower surface; lateral veins 10 to 14 per side, plus intermediates, flat or inscribed on the upper surface, prominent on the lower surface; submarginal veins similar to the laterals and weakly arched between them, 2–4 mm from the margins; the upper surface glabrate, the midvein persistently puberulent, the lateral veins persistently puberulent near the midvein, the lower surface with persistent, scattered trichomes, the midvein and lateral veins persistently puberulent; glands numerous on both surfaces; base obtuse; margins entire; apex abruptly caudate-aristate, the tip 20–30 mm, sharply pointed; petioles 12–20 mm, puberulent, terete or flattened dorsally. Inflorescence, flowers, attached fruits not seen. Fruits ca. 45 × 55 mm, oblate, the pericarp fleshy, costate with 20 to 40 prominent ridges; calyx and tube persistent; mature color yellow; sweet and aromatic.

Habitat, distribution, and phenology. Wet forests, Atlántico Sur (formerly Zelaya), Nicaragua, 200–300 m. Collected in fruit in November.

Identified in the *Flora de Nicaragua* (Sánchez Vindas, 2001) as *Plinia povedae* P. E. Sánchez. However, *P. nicaraguensis* differs in its leaves with fewer lateral veins (to 14 plus a few intermediates, vs. to 40 in *P. povedae*), abruptly caudate-aristate apices and longer petioles (to 20 mm vs. 12 mm in

P. povedae), and fruits with more numerous (20 to 40 vs. 8 to 16) prominent ridges. The leaf apices of *Plinia cuspidata* are similar in form but longer (30–40 mm) and it, too, has shorter petioles, only to 10 mm.

Paratype. NICARAGUA. **Atlántico Sur:** Nueva Guinea, Río el Zapote, *Laguna 61* (MO).

9. Plinia panamensis Barrie, sp. nov. TYPE: Panama. Panamá: Gorgas Memorial Labs yellow fever research camp, "Campomento Quatro," 5–10 km NE of Altos de Pacora, on ridge top, 21–24 Nov. 1974, *S. Mori & J. Kallunki 3411* (holotype, MO). Figure 8.

Pliniae darienensi similis, sed foliis laminis praealte impressinervibus vel sulcinervibus et basibus cordatis differt.

Trees to 5 m; young growth velutinous, the trichomes 2–3 mm, white or golden brown; branchlets compressed, bilaterally channeled below the terminal node; bark reddish brown, smooth, velutinous, the trichomes 0.5–2 mm, golden brown; outer scales of vegetative buds not seen. Leaves elliptic to narrowly elliptic, ovate or lanceolate, the blades 14–30 × 4–11 cm, 2.1–3.7 times as long as wide; coriaceous; midvein sulcate on the upper surface, prominent below; lateral veins 25 to 50 per side, inscribed or sulcate on the upper surface, prominent below, interconnected by numerous, inscribed reticulate veins; submarginal veins similar to the laterals, straight, 2–3 mm from the margins; the upper surface of immature leaves sericeous, the trichomes white, 2–3 mm, ultimately glabrate, the midvein, lateral and submarginal veins densely pubescent, the trichomes 1–2 mm, the lower surface sparsely to densely pubescent, more densely so along the midvein, lateral, and submarginal veins, the trichomes 2–3 mm; glands obscure on both surfaces of mature leaves; base cordate; margins revolute; apex caudate, the tip 20–40 mm, sharply pointed; petioles 10–15 mm, tomentose, similar to the midvein, terete. Inflorescence cauliflorous, sessile, flowers 2 to 4; bracts ca. 2 × 1.5 mm, ovate, pubescent on the outer surface, the margins scarious, the apex acute or acuminate; paired in 4 to 8 decussate ranks of decreasing size; buds not seen. Flowers sessile; bracteoles ca. 7 × 3 mm, lanceolate, tomentose on both surfaces, the margins scarious-ciliate, the apex acuminate; hypanthium ca. 7 mm, campanulate, velutinous, the trichomes 2–3 mm, white, the base costate, the ribbing obscured by the vestiture, the tube elongate 3–4 mm beyond the summit of the ovary, 4–5 mm diam. at the staminal ring; calyx lobes 5–6 × 3 mm, oblong, tomentose on the outer surface and at the tips within, the margins irregular, the apex broadly acute; petals not seen; stamens not seen; style not seen. Fruits 70–120 mm diam., oblate, the pericarp fleshy, costate, the ribs 4 to 8, prominent; calyx tube persistent; mature color yellow.

Habitat, distribution, and phenology. Wet forests, central Panama. 600–900 m. Collected in fruit in April, July, and November.

Plinia panamensis is distinguished by the large leaves with cordate bases, numerous, deeply inscribed to impressed lateral veins and similarly impressed, nearly straight submarginal veins, 2–3 mm from the margins. The large fruits, 7–12 cm in diameter, have 4 to 8 prominent ribs. This species is most similar to *Plinia darienensis,* which has leaves of comparable size, but the veins are not impressed and the leaf base is cuneate. The fruits of the latter species are similar in appearance but smaller, at least in the few specimens examined.

Plina povedae, which is found in western Panama and Costa Rica, also has velutinous branchlets and leaves of similar size, with similar lateral and marginal veins, but the leaf bases are cuneate and the fruits are much smaller, 25–50 mm in diameter.

Paratypes. PANAMA. **Coclé:** Continental Divide N of Penonome on rd. to Coclecito, *Hammel 4034* (MO). **Colón:** Cerro Brewster, P. N. Chagres, *Aguilar et al. 969* (F). **San Blas:** *de Nevers et al. 5378* (MO).

10. Plinia peroblata (Lundell) Lundell, Wrightia 3: 124. 1965. *Eugenia peroblata* Lundell, Wrightia 2: 124. 1961. TYPE: Belize. Cayo: Gorge Creek section, Hummingbird Hwy., 26 Aug. 1955, *P. Gentle 8845* (holotype, LL).

Trees to 10 m; young growth not seen. Branchlets somewhat compressed at the nodes; bark white, pubescent, the trichomes ca. 0.3 mm, straight and recurved, reddish; vegetative buds not seen. Leaves ovate to elliptic, the blades 9–12 × 2.5–4 cm, 3.2–3.8 times as long as wide; chartaceous; midvein convex on the upper surface, prominent on the lower surface; lateral veins 12 to 15 per side, flat or slightly convex on both surfaces; submarginal veins similar to the laterals and weakly arched between them, 2–3 mm from the margins; vestiture restricted to trichomes along the upper edge of the margins, or with a few persistent trichomes near the base of the lower surface and the midvein pubescent below, the trichomes 0.2–0.3 mm, or glabrate on both surfaces; glands obscure on the upper surface, scattered on the lower surface; base cuneate, margins revolute; apex acuminate to caudate acuminate; petioles 5–10 mm, terete or weakly flat-

A. Laguna 156

HOLOTYPE: ***Plinia nicaraguensis*** Barrie, sp. nov.

F.R. Barrie July 2003
MISSOURI BOTANICAL GARDEN [MO]

Figure 7. *Plinia nicaraguensis* Barrie (*Laguna 156*; holotype, MO).

tened dorsally, pubescent, the vestiture similar to that of the branchlets. Inflorescence cauliflorous; not seen. Flowers not seen. Fruits ca. 12 × 25 mm, lenticular, sessile; pericarp fleshy, the surface irregular, lacking well-defined ridges; mature color orange; sweet.

Habitat, distribution, and phenology. Evergreen wet forests, Belize, at elevations of 0–100 m. Collected in fruit August to September.

Plinia peroblata is known only from three collections, two fruiting and one sterile, and is the only *Plinia* known from Belize. The strongly compressed

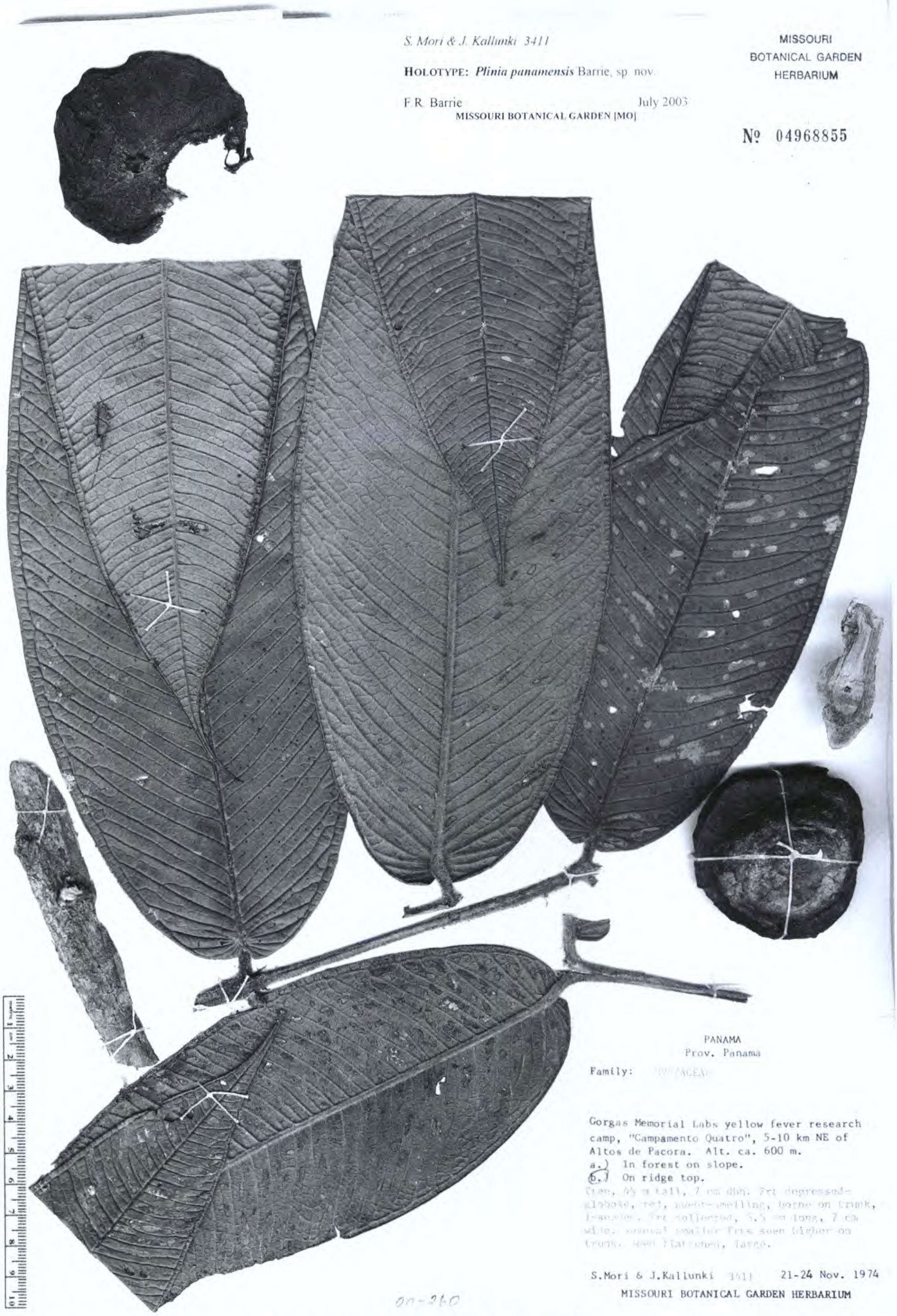

Figure 8. *Plinia panamensis* Barrie (*Mori & Kallunki 3411*; holotype, MO).

fruits are most similar to those of *P. coclensis*. The combination of cauliflorous inflorescence and sessile flowers, and the lenticular fruits, will distinguish this species from any other Belizian Myrtaceae.

Additional specimens examined. BELIZE. **Toledo:** Bladen Nature Reserve, NE lowlands, near plot 2, *Brewer 321* (DAV, F); Bladen Nature Reserve, NE lowlands, Plot 2, tree no. 1382, *Brewer 844* (DAV, F).

11. Plinia povedae P. E. Sánchez, Brenesia 25–26: 313. 1986 [1988]. TYPE: Costa Rica. Puntarenas: Alto de los Mogos, camino a Rincón de Osa, 30 May 1985, *N. Zamora V. & L. J. Poveda 975* (holotype, CR; isotypes, CR, F, MO).

Illustration. P. E. Sánchez V., Brenesia 25–26: 315; f. 1. 1986.

Shrubs or trees, 4–6 m; young growth velutinous, the trichomes to 3 mm, white or golden; branchlets compressed at the terminal nodes; bark smooth, reddish, coarsely tomentose, the trichomes 0.5–1.5 mm, straight or recurved, white, golden, or sordid; outer scales of vegetative buds 1–3 × 1.5–3 mm, widely ovate, convex, pubescent on the outer surface, the margins scarious, the apex acute, the ultimate tip mucronulate. Leaves elliptic to narrowly elliptic or oblanceolate, the blades 14–40 × 4–10 cm, 2.5–5.5 times as long as wide; chartaceous; drying a concolorous green or olive; midvein convex between 2 parallel grooves on the upper surface, prominent on the lower surface; lateral veins 20 to 40, inscribed to impressed in the upper surface, prominent on the lower surface; submarginal veins similar to the laterals, straight, 4–5 mm from the margins; persistently pubescent along the midvein and the lateral veins or ultimately glabrate; glands numerous on both surfaces, obscure on mature leaves; base cuneate; margins revolute; apex acuminate to caudate, the tip to 40 mm; petioles 8–12 mm, terete, pubescent, the trichomes ca. 0.3 mm, straight or recurved. Inflorescence cauliflorous, sessile, solitary or in groups of 2 to 3; bracts 4-ranked, the larger bracts 4–5 × 4–5 mm, the smaller ca. 2 2 mm, ovate or oblong, tomentose on the outer surface, the margins ciliate, the apex rounded; buds pyriform, ca. 8 mm, tomentose, the apical pore ca. 5 mm across, the calyx lobes triangular, 2 × 3 mm. Flowers sessile; bracteoles 4–5 × 3 mm, tomentose on the outer surface, the base free, the margins ciliate, the apex rounded; hypanthium ca. 10 mm, campanulate, costate, the tube prolonged ca. 6 mm above the ovary, ca. 6 mm diam. at the staminal ring, uniformly tomentose or the trichomes somewhat thinner near the apex; calyx lobes ca. 5 × 5 mm, oblong, tomentose on the inner and outer surface, the margins irregular, the apex ciliate; petals not seen; stamens ca. 100, ca. 7 mm; style not seen. Fruits 25–50 mm diam., oblate, the calyx tube persistent on developing fruit; pericarp fleshy, costate, the ribs 6 to 8(to 16), prominent, ca. 2 mm across, villosulous; mature color unknown.

Habitat, distribution, and phenology. Tropical and premontane wet forests, eastern Costa Rica and western Panama, 0–700 m. Collected in flower February and October; collected in fruit April to June and October.

Plinia povedae is similar to *P. panamensis* in several respects. Both have velutinous branchlets, with white or golden hairs to 3 mm long, and large leaves with numerous, inscribed lateral veins. However, in *P. panamensis* the shape of the leaves varies from elliptic to ovate or lanceolate, whereas here they vary from elliptic to narrowly elliptic or oblanceolate. *Plinia panamensis* differs also in having cordate leaf bases and in its much larger fruits, 70–120 mm in diameter versus 25–50 mm here.

Some of the specimens placed under *Plinia cuspidata*, *P. moralesii*, or *P. nicaraguensis* in this treatment have been previously annotated as *P. povedae*. As a group, the three species are most readily separated from *P. povedae* by having leaves with no more than 18 lateral veins per side.

Additional specimens examined. COSTA RICA. **Heredia:** Sarapiquí, Llanura de San Carlos, La Virgen, *Zamora et al. 2524* (INB, MO). **Limón:** El Progresso, entre Cerro Muchilla y Cerro Avioneta, cabeceras de Río Suruy, Fila Matama, Valle de la Estrella, *Herrera & Chacón 2643* (CR, F, MO). **Puntarenas:** Res. For. Golfo Dulce, Osa Peninsula, Rancho Quemado, ca. 15 km W of Rincón, NW end of valley, near Fila Ganado, *Hammel et al. 16886* (CR, F, MEXU, MO), *Hammel et al. 16988* (CR, F, MO, TEX); Sierpe, W of Rancho Quemada on road to Drake, *Maas et al. 7873* (F, MO); Alto de los Mogos, Pt. Jiménez, *Rodríguez M. 13* (CR); camino a Rincón de Osa, *Zamora & Sánchez 1185* (CR). **San José:** Pérez Zeledón, Tinamaste, Finca de los Suizos, *Estrada 2129* (CR). PANAMA. **Bocas del Toro:** along road above Chiriquí Grande, *McPherson 7341* (F). **Veraguas:** Isla Canales, P. N. Coiba, *Galdames et al. 2608* (F), *Galdames et al. 2609* (F), *Galdames et al. 2624* (F).

12. Plinia puriscalensis P. E. Sánchez & Q. Jiménez, Brenesia 32: 113. 1989 [1990]. TYPE: Costa Rica. San José: Zona Protectora La Cangreja, Santa Rosa de Puriscal, 29 Apr. 1988, *Q. Jiménez & P. E. Sánchez 586* (holotype, CR; isotypes, CR, F, MO).

Illustration. Brenesia 32: 116, f. 1. 1989 [1990].

Tree or shrub to ca. 7 m; young growth not seen; vestiture unknown; branchlets weakly compressed, slender, flexible; bark reddish brown, flaking, puberulent, the trichomes erect or recurved; outer scales of vegetative buds 1–1.5 × 1–1.5 mm, broadly ovate, convex, coarsely pubescent, the trichomes ca. 0.5 mm, the margins ciliate, the apex acute. Leaves lanceolate to narrowly elliptic, the blades 5.5–9 × 1.5–2.5 cm, 3–3.7 times as long as wide; chartaceous; drying dark green above, paler below; midvein flat or convex on the upper surface, convex on the lower surface; lateral veins 15 to 25 plus intermediates, obscure on the upper surface, raised on the lower surface; submarginal veins similar to the laterals and arched between them, 1–2 mm from the margins; persistently puberulent only along the midvein on the upper surface, glabrate or with a few, scattered trichomes on the lower surface; glands obscure on both surfaces; base cuneate; margins planate; apex acuminate or caudate acuminate; petioles 8–10 mm, brown, pubescent, terete. Inflorescences cauliflorous, sessile, flowers 2 to 4; bracts ca. 1 × 0.5 mm, ovate, the margins ciliate, the apex acuminate; buds ca. 4 mm, obovoid, the base tomentose, the hypanthium tube glabrous, the apical pore ca. 1 mm across. Flowers sessile, the hypanthium campanulate, the tube prolonged 2–3 mm above the ovary, 3–4 mm across at the staminal ring; the base of the hypanthium tomentose, the tube glabrous within and without, glandular on the outer surface; calyx lobes 1.5–2.5 × 2.5–4 mm, irregular, reflexed at anthesis; petals 1.5–2 × 1.5–2 mm, broadly ovate, puberulent on both surfaces, the margins irregular; stamens ca. 80, 6–8 mm; style ca. 10 mm, glabrous. Fruits 30–50 mm diam., oblate or subglobose; pericarp fleshy, developing fruits with numerous ribs, ultimately the surface irregular, without well-defined ribbing; calyx persistent in developing fruit; mature color yellow; fragrant.

Habitat, distribution, and phenology. Apparently endemic to gallery forests in the Zona Protectora la Cangreja, San José Province, Costa Rica, 500–1000 m. Collected in flower in April; collected in fruit September to October.

Plinia puriscalensis is readily distinguished from other Costa Rican *Plinia* by the lanceolate or narrowly elliptic leaves, no more than 9 cm long. The leaves are most similar to those of the Panamanian species *P. coclensis*, which has lenticular, rather than oblate or subglobose, fruits.

Additional specimens examined. COSTA RICA. **San José:** Zona Protectora La Cangrega, Santa Rosa de Puriscal, *Jiménez 917* (CR, F, MO); Z. P. La Cangrega, Santa Rosa de Puriscal, *Morales 539* (CR, MO); San Martín de Puriscal, en la Fila Vara Blanca, cabecera de Río Negro, límite NW Cangrega, *Morales 3904* (INB, MO); Cerros de Puriscal, San Martín de Puriscal, En Tacotal, *Ramírez et al. 363* (CR, F, INB, MO); Bosque de Cangreja, Sta. Rosa de Puriscal, *Zamora & Jiménez 1288* (CR, F, K, MO).

13. Plinia salamancana (Standley) Barrie, comb. nov. Basionym: *Eugenia salamancana* Standley, Ann. Missouri Bot. Gard. 26: 295. 1939. TYPE: Panama. Panamá: vic. of Salamanca Hydrographic Station, R. Pequení, 28–29 July 1938, *R. E. Woodson, P. H. Allen & R. J. Siebert 1570* (holotype, F; isotypes, MO, NY). Figure 9.

Shrubs or trees to 6 m; young growth sericeous, the trichomes 0.5–2 mm, white. Branchlets compressed; bark reddish or gray, flaking, puberulent, the trichomes ca. 0.3 mm, straight or recurved; vegetative buds not seen. Leaves elliptic or oblong, the blades 6–10 × 2–3.5 cm, 2.5–2.8 times as long as wide; coriaceous; midvein flat on the upper surface, prominent on the lower surface; lateral veins 16 to 22 per side, obscure on the upper surface in mature leaves; submarginal veins similar to the laterals, straight, 1–2 mm from the margins; the upper surface glabrate or with persistent trichomes along the midvein and margins, the lower surface with persistent, appressed trichomes, the midvein persistently sericeous; glands numerous, small, punctate in the upper surface of mature leaves; base cuneate or obtuse; margins revolute; apex acuminate or caudate, the tip 10–25 mm, sharply pointed; petioles 4–9 mm, puberulent, flattened dorsally, becoming corky with age. Inflorescences cauliflorous, bracts 1–2 × 1–2 mm, ovate pubescent on both surfaces, the margins ciliate, the apex acute. Flowers not seen. Fruits 15 × 17–25 mm, oblate; pericarp fleshy, obscurely ribbed, pubescent near the apex; mature color yellow.

Habitat, distribution, and phenology. Premontane and montane wet forests, central Panama, 100–800 m. Collected in fruit March to May.

The holotype and isotypes of *Eugenia salamancana* bear several sessile, cauliflorous inflorescence buds, but are otherwise sterile. The buds, enclosed in five or six ranks of decussate bracts, indicate that the taxon is more appropriately placed in *Plinia*. The elliptic or oblong leaves with the lateral veins often obscure on the upper surface and the numerous minute, punctate glands are similar to those of *P. gentryi*, but the leaves of *P. salamancana* have acuminate or caudate, sharply pointed apices and shorter petioles (to 9 mm vs. 15 mm in *P. gentryi*).

Figure 9. *Plinia salamancana* (Standley) Barrie (*Woodson et al. 1570*; holotype, F).

Additional specimens examined. PANAMA. **Colón:** Santa Rita Arriba, 2–4 km de la carr. Boyd–Roosevelt, *Correa A. et al. 11518* (F); Santa Rita Ridge, forest along trail bey. rd. end, *McPherson 10238* (F, MO). **Panamá:** Cerro Jefé, *Gómez-Pompa et al. 3070* (BM, MO); along road curling around summit, *McPherson 10633* (F, MO); along trail off road tow. Alto Pacora, *McPherson & Stockwell 10883* (MO); desviación 300 m antes de llegar a la torre, *Valdespino et al. 693* (MO); cabecera del río San Cristóbal, *Valdespino et al. 686* (MO).

14. Plinia salticola McVaugh, Fieldiana, Bot. 29:

505. 1963. TYPE: Costa Rica. San José: Cataratas de San Ramón, 21 Feb. 1931, *A. M. Brenes 13443* (holotype, NY; isotype, F).

Illustration. McVaugh, Fieldiana, Bot. 29: 505, f. 13. 1963.

Trees to ca. 8 m; young growth sericeous, the trichomes golden, 1–2 mm; branchlets weakly compressed; bark reddish brown, puberulent, the trichomes ca. 0.3 mm, straight or recurved; outer scales of the vegetative buds 1–3 × 3 mm, widely ovate, convex, sparsely pubescent on the outer surface, the margins ciliate, the apex rounded. Leaves elliptic, the blades 9–17 × 3–6 cm, 2–3 times as long as wide; chartaceous; drying a concolorous green; midvein flat or convex on the upper surface, convex on the lower surface; lateral veins 6 to 10 per side, flat or slightly convex on both surfaces; submarginal veins similar to the laterals and arched between them, 5–8 mm from the margins; the upper surface glabrate, the midvein puberulent, the trichomes ca. 0.1 mm, the lower surface glabrate or with a few trichomes near the base, the midvein puberulent; glands numerous, obscure on one or both surfaces of mature leaves; base cuneate; margins entire; apex acuminate; petioles 6–13 mm, pubescent, the trichomes ca. 0.2 mm, sulcate or flattened dorsally. Inflorescences cauliflorous, sessile, flowers 2 to 4; bracts 2–3 × 1–2 mm, ovate, sparsely pubescent on the outer surface, the margins scarious, the apex acute; buds 5–10 mm, pyriform, initially strigose, ultimately the base puberulent, the apex glabrate. Flowers sessile; bracteoles 1.5–2 × 1–1.5 mm, sparsely pubescent on the outer surface, the margins scarious-ciliate, the apex acute; hypanthium 7–9 mm, campanulate, the base tomentose, the tube prolonged 4–5 mm beyond the summit of the ovary, glabrous or with a few hairs on the outer surface, ca. 5 mm diam. at the base of the staminal ring; calyx lobes ca. 3 × 2 mm, obovate or oblong, the margins and apex irregular; petals ca. 4 × 4 mm, widely elliptic, white, the margins scarious; stamens ca. 150, 5–7 mm; style 10–15 mm. Fruits ca. 60 mm diam., oblate; pericarp fleshy, the surface of immature fruits undulate or with poorly defined ridges, the surface of mature fruits apparently smooth, glabrous or with a few scattered trichomes; calyx persistent in developing fruit; mature color unknown.

Habitat, distribution, and phenology. Wet montane forests from Monteverde in Alajuela, Costa Rica, east to Chiriquí, Panama, 500–1300 m. Collected in flower in September; collected in fruit February to December.

Plinia salticola has widely ovate bud scales with rounded apices and leaves with relatively few (6 to 10) lateral veins that are flat or slightly raised and somewhat remote submarginal veins, 5–8 mm from the margins. The fruits are glabrous or nearly so, with an undulate surface when immature, though it is apparently smooth in mature fruit. The ranges of *P. salticola* and *P. moralesii* overlap in central Costa Rica. The latter species differs in having leaves with a greater number of lateral veins (12 to 18 per side) and longer petioles (15–20 mm). The hypanthium is campanulate in both species, but in *P. moralesii* it is 10–15 mm long and uniformly tomentose on the outside, while in *P. salticola*, it is 7–9 mm long and tomentose near the base only.

Additional specimens examined. COSTA RICA. **Alajuela:** UCR Reserva, Volcán Muerte, above the headwaters of the Río San Lorenzo, *Berringer & Gómez-Laurito 2554* (F); San Ramón, R. F. de San Ramón, on slopes above & in the valley of the Río San Lorencito, *Burger et al. 12122* (CR, F, MO); Est. Biol., *Burger et al. 12446* (F); Faldas de la Fila Volcán Muerto, *Gómez-Laurito 8288* (CR), *Gómez-Laurito 10027* (CR, F); ca. Col. Palmareña, *Gómez-Laurito 10549* (CR, F), *Herrera et al. 310* (F, MO), *Wattenberg & Rivera 15* (CR); Est. río San Lorencito, sendero El Saíno, *Morales et al. 1427* (CR, MO); R. F. Arenal, río Peñas Blancas, Quebrada Agua Gata, Finca La Mona, *Obando 110* (CR, MO); Monteverde Reserve, Peñas Blancas river valley, *Haber et al. 6099* (CR, F, MO); Quebrada Celeste, *Haber & Bello C.7047* (CR, F, MO). **Limón:** El Progreso, fila Matama, valle de La Estrella, *Herrera & Chacón 2712* (R, F, MO). **Puntarenas:** Rancho Quemado, cabeceras de Quebrada Quebradona, finca Florencia, *Marín 52* (CR, MO). **San José:** Puriscal, Faldas Fila Vara Blanca, San Martín de Puriscal, *Jiménez et al. 1427* (MO); Z. P. Cerros Turrubares, Turrubares, Faldas del Cerro Bares, *Jiménez et al. 931* (CR, F). PANAMA. **Chiriquí:** vic. Fortuna Dam, forested slopes along ridge at S boundary of watershed, *McPherson 9089* (MO), in valley S of lake, *McPherson & Aranda 10109* (F).

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New Species of *Anthurium* Sect. *Semaeophyllium* (Araceae) from Central and South America

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ABSTRACT. Seven new species of *Anthurium* with trilobed leaves belonging to section *Semaeophyllium* (Araceae) have been discovered and are here published for the first time. They include: *Anthurium ancuashii* from Peru, *A. chimborazense* from southern Ecuador, *A. ternifolium* and *A. pinkleyi* from northeastern Ecuador, *A. constrictum* and *A. moronense* from southeastern Ecuador and Peru, and *A. rotundatum* ranging from southern Costa Rica and Panama to northern Colombia.

RESUMEN. Siete nuevas especies de *Anthurium* con hojas trilobadas, pertenecientes a la sección *Semaeophyllium* (Araceae), han sido descubiertas y aquí se publican por primera vez. Ellas incluyen: *Anthurium ancuashii* de Perú, *A. chimborazense* del sur de Ecuador, *A. ternifolium* y *A. pinkleyi* del noreste de Ecuador, *A. constrictum* y *A. moronense* del sureste de Ecuador y Perú, y *A. rotundatum* distribuída desde el sur de Costa Rica y Panamá hasta el norte de Colombia.

Key words: *Anthurium*, Araceae, *Semaeophyllium*, trilobed leaves.

Anthurium Schott is an exclusively Neotropical genus and one of the most diverse within the family Araceae, with approximately 1000 species (Croat, 1994). It is recognized by being typically terrestrial or epiphytic, having leaf blades with reticulate tertiary venation and collective veins, and by its bisexual flowers with four tepals that are arranged in a uniform spadix subtended by an open, often persistent spathe. Leaf morphology is one of the most variable characteristics within *Anthurium*, and that has led to the description of several sections (Croat & Sheffer, 1983). One of the most easily recognizable of these groups is section *Semaeophyllium*, characterized by having trilobed leaves with pedate venation and lobes that are united at the base. It was first recognized by H. C. Schott in his *Prodromis Systematis* (Schott, 1860), and formal revision of section *Semaeophyllium* is currently being carried out by the authors (Carlsen & Croat, in prep.). Section *Semaeophyllium* ranges from southwestern Nicaragua into Costa Rica and Panama to Colombia, Venezuela, and Ecuador into northern Peru. The species diversity increases considerably north to south, from Panama to Colombia, and especially into Ecuador.

All measurements included in the descriptions of new species presented here are based on dried herbarium specimens. Features that distinguish juvenile specimens are included between square brackets. Characteristics that occur in less than 5% of the specimens examined are placed between parentheses. Colors of fresh leaf blades, petiole, peduncle, spadix, and spathe, as well as habit and cross section of the petiole, were recorded from the specimen labels. Colors of dry parts are specified as such.

Anthurium ancuashii Croat & Carlsen, sp. nov. TYPE: Peru. Amazonas: Quebrada Kayamas along Río Cenepa, ca. 300 m, 14 May 1973, *E. Ancuash 365* (holotype, MO 3116682–3116683 [2]; isotype, USM). Figure 1A.

Planta terrestris aut epiphytica. Folium petiolo pedunculo longiore; lamina profunde triloba usque ad 5–10 cm e basi fissa, lobis lateralibus falcatis, costis posticis nudis, venis collectivis lobi medii in illas loborum lateralium confluentibus. Inflorescentia spatha viridi; spadice sessili vel breviter stipitato, albo, longe acuminato.

Terrestrial, occasionally epiphytic; internodes 1–2 × 1.5–2.5 cm; cataphylls drying reddish brown, 5–7 cm long, a few of the uppermost cataphylls persisting, partly decomposed, ultimately deciduous. *Leaves* erect-spreading; *petiole* 48–80 cm × 5–8 mm, drying grayish, matte; geniculum 1–2 cm × 5–7 mm; *blades* deeply trilobed to 5–10 cm from the base, subcoriaceous, 35–56 × 28–40 cm, upper surface darker, drying grayish tan, small raphides visible at 10×, base cuneate to truncate; central lobe oblanceolate to oblong-oblanceolate, 28–48 × 7–16 cm, apex acuminate; midrib raised above, rounded, raised below, angled; primary lateral veins 7 to 10 per side, arcuate-ascending, weakly raised above, more prominently raised below, departing midrib at ca. 30°; tertiary veins prominulous; col-

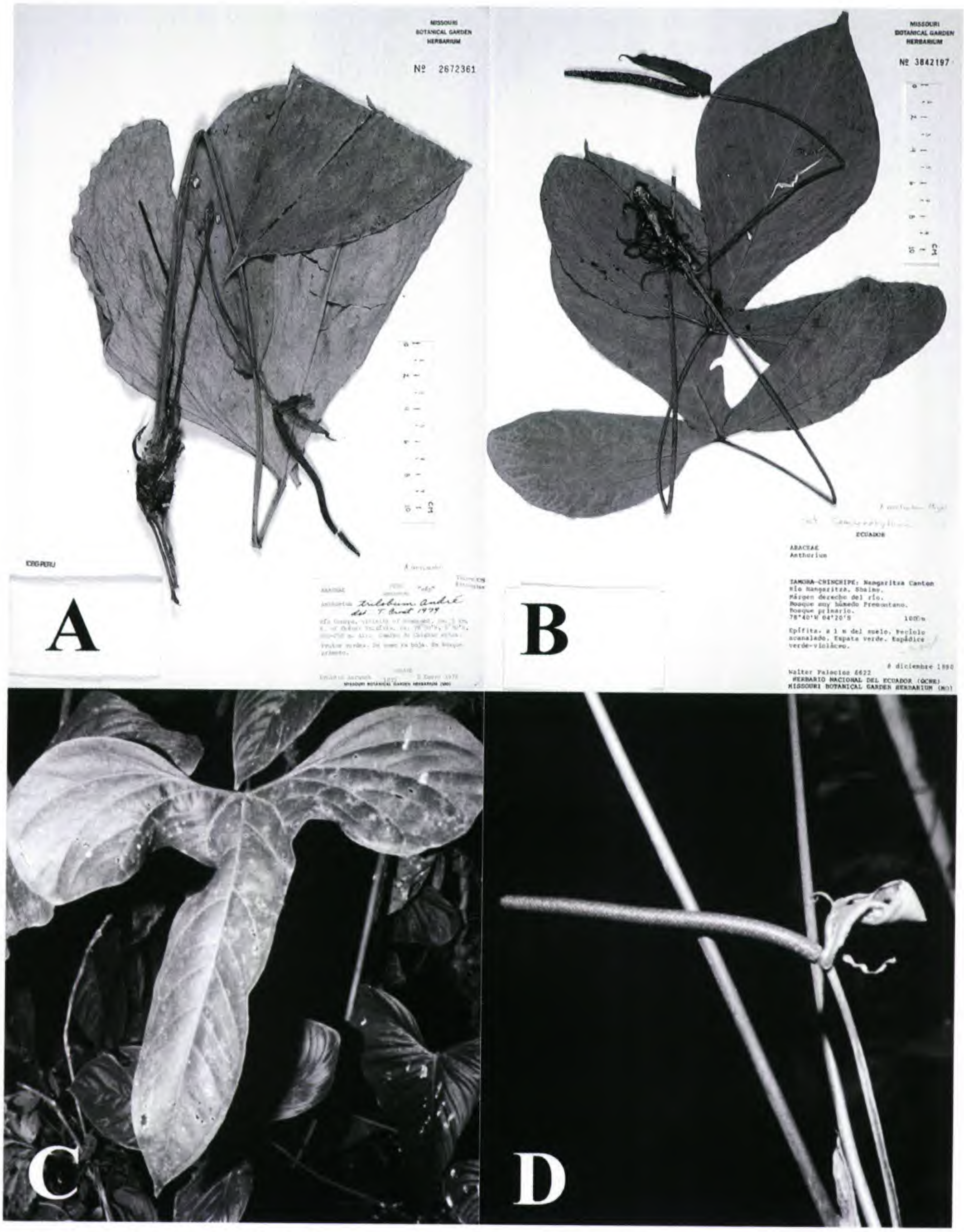


Figure 1. —A. Representative herbarium specimen of *Anthurium ancuashii* Croat & Carlsen (*Ancuash 1235*, MO). —B. Holotype specimen of *Anthurium constrictum* Croat & Carlsen (*Palacios 6622*, MO). C, D. *Anthurium chimborazense* Croat & Carlsen (*Croat 61556*). —C. Leaf showing naked posterior rib and spreading, rounded lateral lobes, adaxial surface. —D. Detail of immature inflorescence.

lective veins arising from the first or second lowermost pair of primary lateral veins, 3–8 mm from the margin, usually loosely connected to that of the lateral lobes, sunken above, raised below, rounded; lateral lobes falcate, 50°–70°(–90°) from central lobe, 23–34 × (4–)7–11 cm, apex narrowly rounded, inner margin straight (convex), outer margin concave; basal veins 3 or 4 pairs, 2 or 3 of them joined for 6–13 cm; posterior ribs almost straight, 45°–60° from midrib, naked for up to 4 cm. *Inflorescence* erect-spreading; peduncle 18–44 cm × 2–3 mm, shorter than petiole; *spathe* green, linear-

lanceolate, 8–10 cm × 6–10 mm, apex narrowly acuminate, base shortly decurrent for 4 mm; spadix sessile (shortly stipitate, 1–2 mm long), white, long-tapered, 8–11 cm × 4–8 mm diam. at base, 2–3 mm diam. at apex; 6 to 8 flowers per principal spiral, rhombic, 1.8–1.9 × 1.2–1.5 mm, sides straight; tepals matte to weakly glossy, covered with whitish granular, weakly raised structures; lateral tepals 0.9–1.1 mm wide, inner margin rounded, turned upward against the weakly emergent pistil, outer margin bluntly angled; stamens weakly exserted; anthers ca. 0.3 × 0.6 mm, thecae ovoid, slightly divaricate; pistils weakly emergent; stigma slit-like, ca. 0.4 mm across. *Infructescence* ca. 1 cm diam.; fruits whitish green, becoming dark purple, obovoid, 4–5 × 3.5–5 mm.

Anthurium ancuashii is known only from northeastern Peru in the Río Cenepa drainage, very close to the Ecuadorian border, between 200 and 300 m, in tropical wet forests (Fig. 4A). The species is named in honor of the first collector, Ernesto Ancuash, a local collector for Brent Berlin who conducted anthropological studies in that region in the 1970s.

Anthurium ancuashii is recognized by the collective veins of the central lobe being connected to those of the lateral lobes, its naked posterior ribs, falcate lateral lobes, and its long-tapered, sessile, white spadix. The grayish color of dried blades is also characteristic, although it may be due to treatment with formaldehyde prior to drying.

Within Peru, *Anthurium ancuashii* could be confused with *A. huallagense* Engler, both having naked posterior ribs and the peduncle shorter than the petiole. The latter differs in having spreading lateral lobes with broadly rounded apices, and wider central lobe (10–30 cm across). Elsewhere, *A. ancuashii* can also be confused with *A. trilobum* André. In fact, the type specimen of *A. ancuashii* was annotated by M. Madison (in 1977) as *A. trilobum*. He indicated on the specimen that although it was morphologically similar to *A. trilobum*, it was geographically disjunct. *Anthurium trilobum* differs in having the posterior ribs winged and a stipitate yellow spadix. It ranges from southwestern Panama to the Pacific coast of Colombia and Ecuador, whereas *A. ancuashii* occurs on the east side of the Andes near the border between Ecuador and Peru.

Paratypes. PERU. **Amazonas:** Río Cenepa, vic. of Huampami, 5 km E of Chávez Valdivia, Quebrada Tujushik, Chigkan entsa, *E. Ancuash 1077* (MO), *E. Ancuash 1235* (MO), *R. Kayap 756* (MO), *A. Kujikat 99* (MO), *A. Kujikat 194* (MO).

Anthurium chimborazense Croat & Carlsen, sp. nov. TYPE: Ecuador. Bolívar-Chimborazo: carretera Pallatanga–Yunguilla–Llimbe, a orillas del Río Chimbo, 1720 m, 7 Sep. 1987, *V. Zak & J. Jaramillo 2806* (holotype, MO 3583458–3583459 [2]; isotypes, NY, US). Figure 1C, D.

Planta epiphytica aut hemiepiphytica. Folium petiolo pedunculo longiore; lamina profunde triloba usque ad (4–)5–11 cm e basi fissa, lobis lateralibus patentibus apicibus late rotundatis, venis basalibus apicem versus acute curvatis, costis posticis nudis et rectis. Inflorescentia spatha viridi apice involuta; spadice sessili, atroviridi, longe acuminato. Floribus antheris tepala superantibus.

Epiphyte or hemiepiphyte; internodes 1–3 × 1–2 cm; cataphylls drying greenish yellow, moderately thin, (4–)7–14 cm long, ultimately deciduous. *Leaves* erect-spreading; petioles 24–44(–65) cm × 3–8 mm, terete to sulcate adaxially; geniculum 1–1.5(–2) cm × 3–6 mm, drying concolorous; *blades* deeply trilobed to (4–)5–11 cm from the base, chartaceous to subcoriaceous, (22–)26–46(–60) × 24–48(–60) cm, dark green and glossy above, moderately paler and glossy below, scattered raphides on the upper surface, base truncate; central lobe oblong to oblong-elliptic to oblong-obovate, 20–37 (–50) × (4–)7–17 cm, apex acuminate; midrib raised above, angled, sunken toward the apex, raised below, rounded; primary lateral veins 6 to 10 per side, arcuate when reaching the collective veins, raised above, rounded, raised below, angled, departing midrib at (30°–)40°–55°; tertiary veins prominulous below; collective veins arising from the first or second lowermost pair of primary lateral veins, (2–)3–5 mm from the margin, scarcely raised to sunken above, raised below, rounded; all major veins on the abaxial side drying yellowish and conspicuously paler than the surface; lateral lobes spreading, (80°–)90° from central lobe, 12–35 × 9–18(–23) cm, (3–)5–10 cm toward base, apex broadly rounded, inner margin concave [slightly convex], outer margin concave; basal veins 4 to 6 (to 8) pairs, the first pair free to the base, the rest joined for 4–7(–11) cm then curved sharply apically; posterior ribs straight, 90° from midrib, naked for 2–5(–9) cm. *Inflorescence* erect-spreading; peduncle 17–45 cm × 3–5 mm, shorter than petiole; *spathe* green, linear-lanceolate, reflexed-spreading, (4.5–)10.5–16(–20) cm × 5–10(–17) mm, apex acuminate, involute, base clasping; *spadix* sessile, deep green, long-tapered, (12–)25–38 cm long, 5–9 mm diam. at base, 3–4 mm diam. at apex; 5 to 8 flowers per principal spiral, rhombic, 1.8–2.5 × 1.4–2 mm, sides straight to weakly sigmoid; tepals thick, lateral tepals 1–1.5 mm wide,

inner margin rounded to straight, outer margin bluntly angular; stamens weakly exserted; anthers 0.4–0.5 × 0.5–0.65 mm, thecae oblong-elliptic, slightly divaricate; pistils weakly emergent; stigma slit-like to ellipsoid, 0.3–0.4 mm across. *Infructescence* unknown.

Anthurium chimborazense is known only from Ecuador in two disjunct mountain ranges, the eastern slopes of the Andes in Chimborazo Province and the Cordillera Chongón-Colonche, near the Pacific coast, in Guayas Province (Fig. 4A). The species occurs in pre-montane and montane moist forests, at lower elevational ranges in Guayas Province (500–700 m) than in Chimborazo (1350–2000 m). The localities in Guayas Province are closer to the ocean, and the consequent increase in humidity causes the vegetation belts to be lower than elsewhere.

Anthurium chimborazense is distinguished by its straight naked posterior ribs and broadly rounded lateral lobes with basal veins curved sharply apically. It also has a spathe that is inrolled at the tip and a sessile, deep green spadix with anthers reaching just above the tepals.

In Ecuador, *Anthurium chimborazense* can be confused with *A. moronense*, a species that occurs in pre-montane forests on the eastern slopes of the Andes between Ecuador and Peru. The latter differs in having a square petiole, blades with the central lobe broadly obovate, and a cylindric, purplish violet spadix. *Anthurium chimborazense* can also be confused with *A. rotundatum* from southern Costa Rica to Colombia, another species with broadly rounded lateral lobes, but with the collective veins 4–8 mm from the margin and a stipitate, bright yellow spadix.

Paratypes. ECUADOR. **Chimborazo:** Hacienda La Carmela, *M. Acosta-Solis 5399* (F); Río Chanchán, ca. 5 km N of Huigra, *W. H. Camp E-3278* (AAU, MO, NY, SEL); rd. betw. Alausi & El Triunfo, 6.9 km W of Huigra, *T. Croat 61564* (MO), *T. Croat 61566* (MO); betw. Guayaquil & Riobamba, near Río Chanchán, Hacienda de Licay, *J. F. Smith 2014* (QCA, WIS). **Guayas:** Cordillera Chongón-Colonche, Bosque Protector Loma Alta, *X. Cornejo & C. Bonifaz 5415* (GB, GUAY, MO), *X. Cornejo & C. Bonifaz 5701* (GUAY, MO); Reserva Ecol. Manglares Churute, Cerro Pancho Diablo, *X. Cornejo & C. Bonifaz 5548* (GUAY, MO); Manabí, San Sebastián, Machalilla National Park, *A. Gentry et al. 72574* (MO).

Anthurium constrictum Croat & Carlsen, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Nangaritza Cantón, Río Nangaritza, Shaime, margen derecho del río, bosque muy húmedo premontano, 4°20′S, 78°40′W, 1000 m, 8 Dec. 1990, *W. Palacios 6622* (holotype, MO 3842197; isotype, QCNE). Figure 1B.

Planta terrestris aut epiphytica. Folium petiolo caniculato vel D-formi; lamina profunde triloba usque ad 2–4(–6) cm e basi fissa, lobo medio basi constricto, lobis lateralibus patentibus aut leviter falcatis apicibus late rotundatis, costis posticis nudis. Inflorescentia spatha viridi; spadice sessili, atropurpureo, cylindrico, gracili.

Terrestrial or epiphytic; internodes short, ca. 1 cm diam.; cataphylls drying yellowish green, 5–9 (–17) cm long, with apiculum 2–4 mm long, persisting intact at uppermost nodes. *Leaves* erect; *petiole* 16–31(–46) cm × 2–4 mm, caniculate to D-shaped; geniculum 1–1.5(–3) cm × 2–4 mm; *blades* deeply trilobed to 2–4(–6) cm from the base, subcoriaceous, 13–27(–35) × 17–36(–40) cm, fresh surface color unknown, very few raphides above, denser and conspicuous below, base truncate to cuneate; central lobe broadly obovate, 12–24(–30) × 7.5–14(–24) cm, 2–4(–6) cm across at base, apex cuspidate; midrib weakly raised to sunken above, raised below, angled; primary lateral veins 9 to 13 per side, straight, weakly raised above, rounded, raised and very conspicuous below, departing midrib at 40°–50°; tertiary veins prominulous; collective veins arising from one of the lowermost primary lateral veins, usually the third pair, 4–5 mm from the margin, weakly raised to sunken above, raised below; lateral lobes spreading to slightly falcate, 60°–70° from central lobe, 8.5–20(–25) × 5–10 (–16) cm, apex broadly rounded, slightly turned forward, inner margin concave to straight, outer margin concave; basal veins 4 or 5 pairs, joined for 1.5–4 cm, all of them separating at the same distance; posterior ribs straight, 80°–90° from midrib, naked for up to 4 cm. *Inflorescence* erect; peduncle 20–29 cm × 3–5 mm, longer than or equal to petiole; *spathe* green, lanceolate, erect, 5–7 × 0.6–1.2 cm, apex long acuminate (tip inrolled), base acute; *spadix* sessile, dark purple, cylindric, 5–9.5 cm × 4–6 mm; 4 to 5 flowers per principal spiral, rhombic, 2.4–3.2 × 1.6–2.8 mm, sides weakly sigmoid; tepals thin and velvety, lateral tepals 0.8–1.1 mm wide, inner margin rounded, outer margin angled; stamens weakly exserted; anthers ca. 0.6 × 0.4 mm, thecae elliptic, slightly divaricate; pistils exposed even in very immature inflorescences; stigma round to elliptic, ca. 0.3 mm across. *Infructescence* purple, up to 6 mm diam.; fruits purple, rounded, covered by scale-like tepals, ca. 2 mm diam.

Anthurium constrictum occurs on the eastern slopes of the Andes in southern Ecuador and northern Peru, along the mountain range that connects the Cordillera de Cutucú and Cordillera del Cóndor (Fig. 4A). It grows in pre-montane and montane wet forests between 800 and 2200 m. The specific epithet refers to the constriction at the base of the

central lobe of the leaf blade. *Anthurium constrictum* is recognized by this constriction, its caniculate to D-shaped petiole, spreading lateral lobes with rounded apices, and sessile, dark purple, slender spadix.

The paratype *T. Croat 72700* has very large leaves and the collective veins are 10 mm from the margin. It was collected in the same geographical area as more typical specimens of *Anthurium constrictum*; all have a generally similar leaf morphology. Collections from Ecuador (*H. van der Werff & W. Palacios 10379, 10382*) differ in having the peduncle shorter than the petiole, which is terete; the stipe is up to 6 mm and the spadix is 11–29 cm long. Peruvian specimens, all collected near the Ecuadorian border, dry yellowish and have internodes 3–8 cm long, but otherwise are very similar in vegetative and reproductive morphology. Further collections may suggest that some of these variants need formal recognition.

Anthurium constrictum can be confused with *A. ternifolium*, another middle-elevation species from Ecuador with naked posterior ribs, D-shaped petiole, peduncle longer than or equal to petiole and very thin, sessile spadix. The latter differs in having blades with an oblong-lanceolate central lobe that is not constricted at the base; falcate, not spreading lateral lobes, and a green, not dark purple, spadix. *Anthurium constrictum* can also be confused with *A. rimbachii* Sodiro. The latter also has blades with a constricted central lobe and a sessile spadix becoming dark purple when old. However, *A. rimbachii* has broader leaves (28–46 cm wide), a broader spadix (5–9 mm diam.), and winged posterior ribs.

Anthurium constrictum is rather similar to *A. alatum* Engler, a Colombian high-elevation species with the same constriction of the central lobe and sessile spadix. However, the latter has falcate lateral lobes, collective veins farther from the margin (5–12 mm in *A. alatum* vs. 4–5 mm in *A. constrictum*), and a green spadix.

Paratypes. ECUADOR. **Morona–Santiago:** Cordillera de Cutucú, rd. Méndez–Morona, *H. van der Werff & W. Palacios 10379* (MO, QCNE), *H. van der Werff & W. Palacios 10382* (MO, QCNE). **Zamora-Chinchipe:** rd. betw. Loja & Zamora, at Río Zamora, *T. Croat 72700* (MO, QCNE); 4 km W of Panguintza, *G. Harling & L. Andersson 24129* (GB, QCA); Cordillera del Cóndor, Shaimi, Río Nangaritza, *W. Palacios et al. 8755* (MO, QCNE). PERU. **Cajamarca:** El Triunfo-Convento, *J. Campos & E. Rodríguez 2820A* (MO); Estrella del Oriente, *J. Campos et al. 4814* (MO); El Progreso, *J. Campos et al. 6287* (MO); San José de Lourdes, *C. Díaz & A. Torres 7797* (MO); Santo Tomás, NE del Marañón, *V. Quipuscoa 406* (MO).

Anthurium moronense Croat & Carlsen, sp. nov. TYPE: Ecuador. Morona–Santiago: Gualaquiza, Misión Bomboiza, Misión Salesiana, 700–800 m, 3 Oct. 1967, *B. Sparre 19282* (holotype, QCA; isotypes, MO 2310065, S). Figure 2A, B.

Planta epiphytica scandens, internodiis 3–6 cm longis. Folium petiolo pedunculo longiore, rubro, quadrangulari; lamina triloba usque ad 6–12 cm e basi fissa, lobo medio apice acuto in apiculum 1–2 mm longum desinente, lobis lateralibus patentibus apicibus late rotundatis, costis posticis nudis. Inflorescentia spatha viridi; spadice sessili, purpurascente, cylindrico.

Climbing epiphyte; internodes 3–6 × 0.8–1.2 cm; cataphylls thick, drying brownish, 7–12 cm long, persisting intact at least at upper nodes. *Leaves* erect; *petiole* 25–45 cm × 4–5 mm, square, reddish; geniculum 1.5–2 cm × 4–7 mm; *blades* trilobed to 6–12 cm from the base, coriaceous, 21–32 × 26–42 cm, pale green below, raphides sunken on upper surface, not easily visible, drying with red-purple dots on a silver-white surface below, base truncate; central lobe broadly obovate, 15–22 × 10–17 cm, apex acute, apiculum 1–2 mm long; midrib raised above and below, rounded; primary lateral veins 5 to 6 per side, arcuate-ascending, weakly raised above, rounded, raised below, departing midrib at 40°–50°; tertiary veins prominulous below; collective veins arising from the first pair of basal veins, 0.8–1.5 cm from the margin, sunken above, raised below; lateral lobes spreading, 90° from central lobe, 15–25 × 8–15 cm, apex broadly rounded, inner margin straight to weakly convex, outer margin concave; basal veins 4 to 6 pairs, the first one free, the second joined for up to 1 cm, the rest joined for up to 5.5 cm; posterior ribs weakly arcuate, 80°–90° from midrib, naked for up to 2.5 cm. *Inflorescence* erect; peduncle reddish, 12–24 cm × 2–6 mm, shorter than petiole; *spathe* green, lanceolate, 6.5–16 × 0.7–2 cm, apex acuminate, base acute; *spadix* sessile, purplish violet, cylindric, 7–14(–20) cm × 4–7 mm; 4 to 6 flowers per principal spiral, rhombic to 4-lobed, 2.5–3 × 2–2.5 mm, sides straight to weakly sigmoid; tepals velvety, lateral tepals ca. 1.2 mm wide, inner margin rounded, outer margin bluntly angled; stamens weakly exserted; anthers ca. 0.5 × 0.45 mm, thecae elliptic, slightly divaricate; pistils weakly emergent; stigma rounded, ca. 0.35 mm across. *Infructescence* with purple spadix, 11–20 × 0.7–1 cm; fruits red-violet, dark at apex, much paler at base, lanceolate with acute apex, ca. 4.5 × 2.5 mm.

Anthurium moronense is found in southeastern

Figure 2. —A. Representative herbarium specimen of *Anthurium moronense* Croat & Carlsen (*Palacios & Neill 6474*, MO). —B. *Anthurium moronense*, showing leaf bases and detail of inflorescence at anthesis (*Sparre 19282*, type collection). C, D. *Anthurium pinkleyi* Croat & Carlsen. —C. Close-up of leaf blade showing spreading lateral lobes with narrowly rounded apex (cultivated plant, *Selby acc. 78-1152*). —D. Detail of inflorescence at anthesis (cultivated, type plant, *Selby acc. 78-1156*).

Ecuador (Morona–Santiago and Zamora-Chinchipe Provinces) and northeastern Peru (Cordillera del Cóndor, near the Ecuadorian border) (Fig. 4A). It grows in pre-montane and montane wet forests between 700 and 1200 m in elevation.

Anthurium moronense is distinguished by its reddish petiole that is square in cross section, its spreading lateral lobes with broadly rounded apex, central lobe with acute apex and an apiculum 1–2 mm long, and its sessile, cylindric and purplish violet spadix.

The species can be confused with *Anthurium truncicola* Engler, an Ecuadorian species that also occurs at medium to high elevations. They both have elongated internodes, and their collective veins arising from the first pair of basal veins, running 8–15 mm distant from the margin. *Anthurium truncicola* differs in having winged posterior ribs and a green, stipitate spadix.

Anthurium moronense might also be confused with *A. platyglossum* Sodiro, but the latter differs in having a terete petiole, winged posterior ribs, and a green, stipitate spadix. These species both grow in Morona–Santiago Province, but *A. platyglossum* occurs at higher elevations (1600–1800 m) there than does *A. moronense* (700–800 m).

Paratypes. ECUADOR. **Morona–Santiago:** Río Cuyes y vía Bomboiza-Gualaquiza, *W. Palacios 1458* (MO, QCA, QCNE); Gualaquiza, Misión Bomboiza, *B. Sparre 19108* (S), *B. Sparre 19114* (S), *B. Sparre 19252* (S). **Zamora-Chinchipe:** Río Nangaritza, Pachicutza, *J. Jaramillo 13943* (QCA), *J. Jaramillo 14092* (QCA), *J. Jaramillo & E. Grijalva 13413* (QCA), *W. Palacios & D. Neill 6474* (MO, QCNE), *W. Palacios et al. 8330* (MO, QCNE); Miazi, detrás del Campamento Militar, *W. Palacios et al. 8506* (MO, QCNE). PERU. **Amazonas:** NW del PV Falso Paquisha, Cordillera del Cóndor, *S. Baldeón 541* (USM); Cordillera del Cóndor, PV Alfonso Ugarte, Río Comainas, *H. Beltrán & R. Foster 795* (MO).

Anthurium pinkleyi Croat & Carlsen, sp. nov.

TYPE: Ecuador. Napo: Limoncocha, 240 m, 20 May 1991, *S. Ingram & D. Atwood 977*, originally collected by M. Madison et al. s.n., Selby accession #78-1156 (holotype, SEL; isotype, MO 4224348). Figure 2C, D.

Planta terrestris. Flos lamina profunde triloba usque ad 4–7 cm e basi fissa, lobis omnibus latitudine aequalibus, lobo medio oblongo vel oblanceolato, lobis lateralibus patentibus apicibus anguste rotundatis, costis posticis nudis. Inflorescentia spatha viridi, purpurascente, fibrosa; spadice sessili, purpureo usque atrobrunneo, cylindrico aut anguste acuminato.

Terrestrial; internodes short, 2–2.5 cm diam.; cataphylls drying reddish brown, 3–6 cm long, deciduous. *Leaves* erect-spreading; *petiole* (20–)33–55 cm × 3–5 mm, terete (slightly D-shaped); geniculum yellow, 1.5–3 cm × 2–3 mm, drying somewhat darker than petiole; *blades* deeply trilobed to 4–7 cm from the base, subcoriaceous, (18–)22–37 × (20–)26–44 cm, medium green above, pale yellowish green below, lower surface drying conspicuously paler than above and silvery, both surfaces matte to semiglossy, raphides usually absent, base acute to truncate; central lobe oblong to oblanceolate, (15–)20–33 × 5–11 cm, apex acuminate, apiculum 2–3 cm long; midrib raised above, somewhat sunken toward the apex, raised below; primary lateral veins 4 to 6 per side, arcuate-ascending, weakly raised above and below, departing midrib at 30°–40°; tertiary veins weakly raised below; collective veins arising from the third (second) pair of primary lateral veins, 4–6 mm from the margin, sunken above, raised below, angled; lateral lobes spreading, 90° from central lobe, 14–22 × 4.5–10 cm, apex narrowly rounded, inner margin convex to straight, outer margin concave; basal veins 5 to 6 pairs, the first one joined for 1–3 cm, the rest up to 8 cm; posterior ribs straight to weakly arcuate, 80°–90° from midrib, naked for 2–3.5 cm. *Inflorescence* erect; peduncle 16–40(–54) cm × 2–4 mm, shorter than petiole (equal); *spathe* green becoming purplish, lanceolate, fibrous, 5.5–9.5 × 0.9–1.5 cm, apex long-acuminate, base meeting peduncle at 90°, somewhat auriculate; *spadix* sessile, purple to dark brown, cylindric to narrowly tapered, stout, 4–9 cm long, 4–8 mm diam. at base, 3–5 mm diam. at apex; ca. 6 flowers per principal spiral, rhombic, 2.8–3.2 × 2.8 mm, sides straight to weakly sigmoid; lateral tepals ca. 2.3 mm wide, inner margin straight to weakly rounded, turned upward when the pistil emerges, outer margin angled; stamens weakly exserted; anthers ca. 0.5 × 0.65 mm, thecae elliptic, slightly divaricate; pistils emergent; stigma elliptic, ca. 0.4 mm across. *Infructescence* dark purple, 8–9 × 1–1.4 cm; fruits green becoming dark purple, roundly ovate, ca. 3 × 2.5 mm.

Anthurium pinkleyi is known only from northeastern Ecuador in Napo and Orellana Provinces (Fig. 4A). It grows in tropical moist forests at less than 500 m in elevation. It is named after its earliest collector, Homer V. Pinkley, who made a specimen in 1966 (*H. Pinkley 278*, ECON) from Dureno, Río Aguarico, just east of Lago Agrio, while conducting ethnobotanical studies in the area.

Anthurium pinkleyi can be recognized by its naked posterior ribs departing from the midrib at 80°–90°, its slender lobes, the central one being oblong and the lateral ones spreading, and its sessile, dark purple, cylindric spadix subtended by a fibrous green to purplish green spathe. Also characteristic

are the tepals that twist upward after the pistil emerges.

Eight of the collections examined, including the type specimen, were made from cultivated plants growing at Marie Selby Botanical Gardens (Selby accessions: 78-1126, 78-1149, and 78-1156), that were originally collected by Madison and colleagues in Ecuador, Napo Province, near Limoncocha in the vicinity of the Río Napo. Apparently no herbarium specimen was made at the time of collection of the living material for cultivation.

When Madison (1978) redescribed *Anthurium rimbachii* Sodiro, he included as a representative specimen one of the collections taken from the type plant of *A. pinkleyi* (*M. Madison 4135*). He did not have the type specimen of *A. rimbachii* on hand and was clearly confusing that species with this new material, because they both have deep purple, sessile spadices. According to the original description of Sodiro (1903), *A. rimbachii* was collected in western Ecuador (Guayas Province) and it differs in having winged posterior ribs and bigger leaf blades (26–58 × 28–46 cm). It also differs in having very long exserted stamens and an obovate central lobe, constricted at the base. Unfortunately, the location of the type specimen of *A. rimbachii* is unknown. However, *A. rimbachii* clearly differs from the material included here in *A. pinkleyi* by all the above-mentioned characters.

In Ecuador, *Anthurium pinkleyi* might also be confused with *A. moronense*, both having purple, sessile spadices. However, the latter species has broader central and lateral lobes (10–17 cm and 8–15 cm wide, respectively) and occurs at higher elevations in southeastern Ecuador. *Anthurium pinkleyi* may be confused with *A. angustilobum* Croat from Panama, both sharing slender, oblong central lobes. The latter differs in having collective veins arising from the first pair of basal veins and running 3–4 mm from the margin, and a stipitate green spadix.

Paratypes. ECUADOR. **Napo:** Limoncocha, originally collected by M. Madison et al., cultivated at Marie Selby Botanical Gardens, *A. Christenson 1108* [SEL 78-1149] (MO, SEL), *T. Croat 79395* (MO), *S. Ingram 1159* [SEL 78-1156] (SEL), *M. Madison s.n.* [SEL 78-1149] (MO), *M. Madison 4135* (SEL), 4 July 1978, *M. Madison et al. s.n.* [SEL 78-1126] (SEL), *T. Plowman 14068* [SEL 78-1149] (F, SEL), *T. Plowman 14069* [SEL 78-1126] (F); Est. Biol. Jatún Sacha, Río Napo, 8 km E de Misahuallí, *C. Cerón 1732* (MO, QCNE); E of Lago Agrio rd. to CEPE Ferry Crossing, *T. Croat 50428* (MO); San Pablo de los Secoyas, *J. Jaramillo & F. Coello 2711* (QCA); Río Aguarico, Dureno, *H. Pinkley 278* (ECON). **Orellana:** P. N. Yasuní, km 46–49 of petroleum pipeline rd., *R. Burnham 1924* (MICH, MO), *D. Neill et al. 10271* (MO, QCNE).

Anthurium rotundatum Croat & Carlsen, sp. nov. TYPE: Panama. Colón: betw. Portobelo & Nombre de Dios, 1.2 mi. beyond road to Isla Grande, 9°40′N, 79°35′W, 5 Apr. 1980, *T. Croat 49788* (holotype, MO 2739714–2739716 [3]; isotypes, COL, F, HUA, PMA, US, WU; living plant at MO). Figure 3A, B.

Planta epiphytica scandens, internodiis usque ad 2 cm longis. Folium petiolo pedunculo longiore; lamina triloba usque ad 7.5–14 cm e basi fissa, lobis lateralibus patentibus vel leviter falcatis apicibus late rotundatis, costis posticis nudis. Inflorescentia spatha pallide viridi; spadice stipitato, vivide flavo, acuminato.

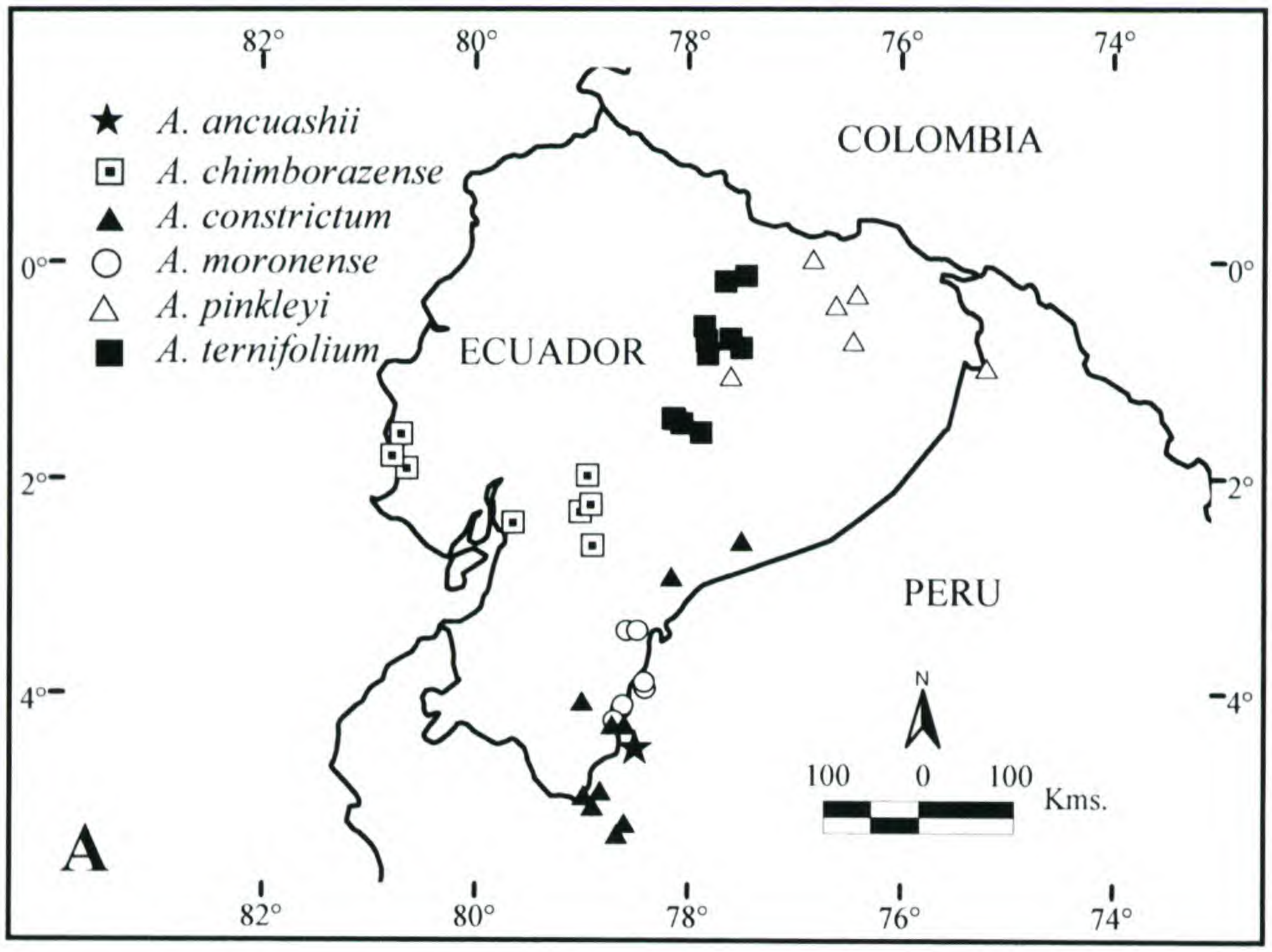
Climbing epiphyte; internodes up to 2 cm long, 2–2.5 cm diam.; cataphylls subcoriaceous, faintly one-ribbed, drying reddish brown, 8–16 cm long, persistent as fibers. *Leaves* erect-spreading; *petiole* (17–)20–77 cm × 5–10 mm, terete (slightly flattened adaxially); geniculum 1–3.5 cm × 4–8 mm; *blades* trilobed to 7.5–14 cm from the base, subcoriaceous, 30–72 × 22–78 cm, green, dull to semiglossy above, pale green, glossy below, upper surface densely covered by raphides, lower surface drying brown-speckled, base cuneate; central lobe oblanceolate to obovate, 25–60 × 8.5–36 cm, apex acuminate; midrib raised above, angled, diminishing and sunken toward the apex, raised below; primary lateral veins (4 to)5 to 9 per side, straight, sunken to weakly raised above, raised below, departing midrib at 30°–45°(–50°); tertiary veins inconspicuous; collective veins arising from one of the lowermost pairs of primary lateral veins [from the first pair of basal veins], 4–8 mm from the margin, sunken above, raised below; lateral lobes spreading to slightly falcate, 70°–90° from central lobe, 11–40 × 6–29 cm, apex broadly rounded, inner margin concave, outer margin concave; basal veins 3 to 6 pairs, joined for (1–)3–8.5 cm (the first pair free); posterior ribs straight to weakly arcuate, 70°–90° from midrib, naked for 1.5–8 cm. *Inflorescence* erect-spreading; peduncle (8–)12–34 cm × 3–6 mm, shorter than petiole; *spathe* pale green, lanceolate, spreading-reflexed, 8.5–35 × 1.5–3 cm, apex acuminate, base acute, decurrent; stipe 0.5–2 cm long; *spadix* bright yellow, tapered, (9–)13–45 cm long, 5–10 mm diam. at base, 3–6 mm diam. at apex; 5 to 10 flowers per principal spiral, rhombic to 4-lobed, 1–2.5 × 1.5–2 mm, sides straight to weakly sigmoid; tepals glossy, lateral tepals 0.5–2 mm wide, inner margin rounded, outer margin angled; stamens weakly exserted; anthers 0.5–1 × 0.5 mm, thecae elliptic, slightly divaricate; pistils scarcely emergent; stigma elliptic, ca. 0.5 mm across. *Infructescence* turning dark red-purple, 25–

Figure 3. A, B. *Anthurium rotundatum* Croat & Carlsen (*Croat 49788*, type plant, cultivated at MO). —A. Detail of inflorescence and leaf. —B. Leaves showing spreading and rounded lateral lobes, abaxial surface. C, D. *Anthurium ternifolium* Croat & Carlsen (*Croat 72829*). —C. Trilobed leaves showing falcate lateral lobes and sunken primary lateral veins. —D. Close-up of immature infructescence.

52 × 1.3–2 cm; fruits dark purple, white at base, obovoid, apiculate, 5–7 × 3–4 mm.

Anthurium rotundatum ranges from the Atlantic slopes of southern Costa Rica to Panama (Atlantic and Pacific slopes) into the very northern tip of Colombia (Fig. 4B). It grows from sea level to 1000 m in elevation, in tropical wet or premontane forest. The specific epithet refers to the almost rounded apex of the lateral lobes of the leaves. *Anthurium rotundatum* is recognized by its naked posterior ribs, spreading lateral lobes with broadly rounded apices, and its stipitate yellow spadix.

Most specimens now attributed to this new species were formerly identified as *Anthurium garagaranum* Standley. However, Croat (1986) pointed out that the Panamanian material he included in *A. garagaranum* differed from the other material in having stout, naked posterior ribs, and shorter, more rounded lateral lobes. *Anthurium rotundatum* and *A. trilobum* share a yellow, stipitate spadix. The



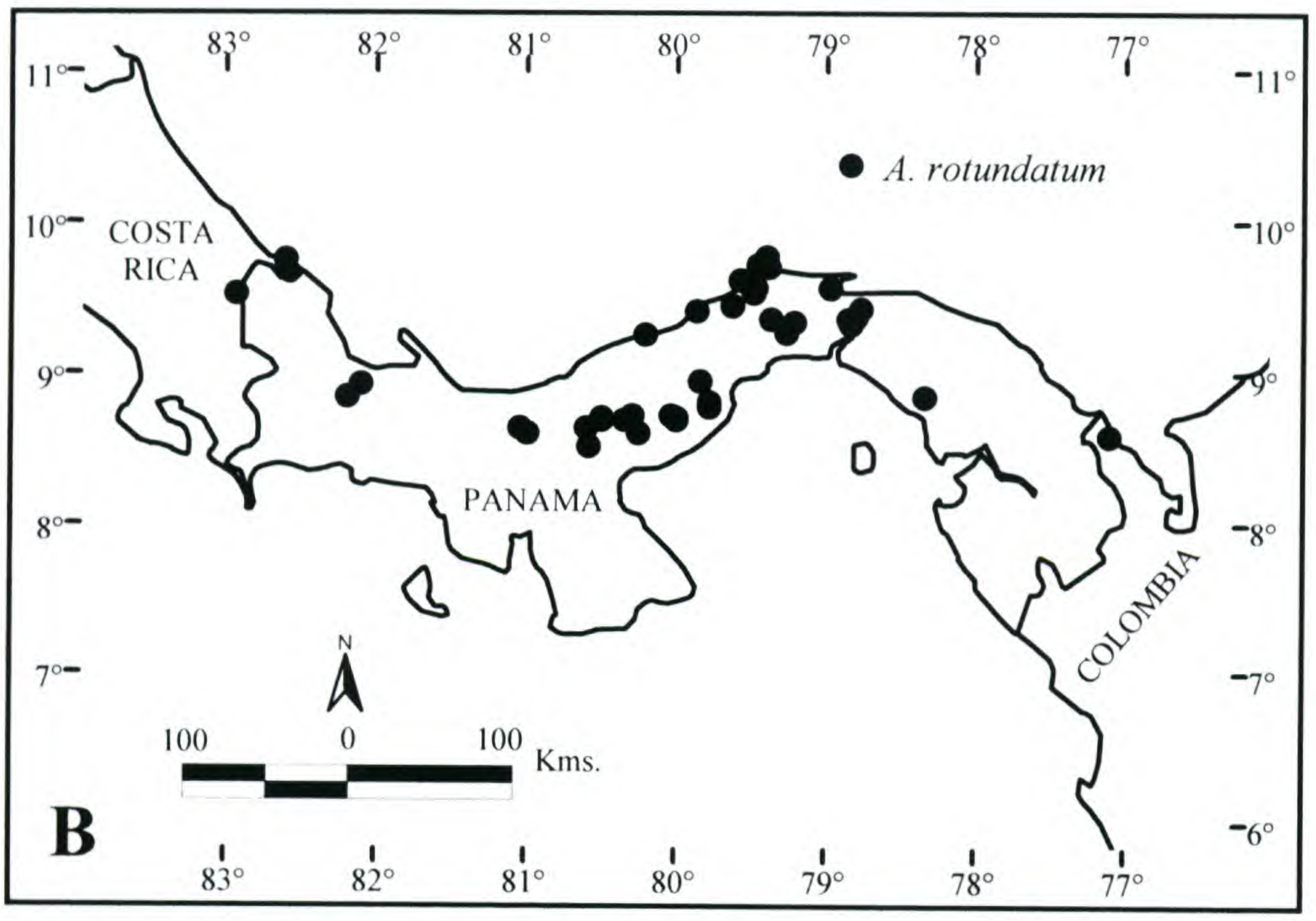


Figure 4. —A (top). Distribution map of six new South American species of *Anthurium* sect. *Semaeophyllium*. —B (bottom). Distribution map of the new Central American species, *Anthurium rotundatum*.

latter differs in having winged posterior ribs, lateral lobes narrowly rounded at apex, and 8 to 14 pairs of primary lateral veins.

Anthurium rotundatum can also be confused with *A. chimborazense* from Ecuador, both sharing naked, straight posterior ribs and spreading lateral lobes, rounded at apex. The latter differs in having the collective veins (2–)3–5 mm from the margin and a sessile deep green spadix.

Paratypes. COSTA RICA. **Limón:** Manzanillo de Talamanca, *M. Grayum & W. Burton 4328* (MO); Qda. Mata de Limón, Finca Anai, *M. Grayum et al. 4446* (MO); unión de Río Urén y Río Sukut, 1.5 km aguas arriba, *G. Herrera 3175* (MO). PANAMA. **Bocas del Toro:** entre la presa y Valle La Esperanza, río Changuinola, *L. Carrasquilla & R. Mendoza 1384* (PMA); rd. betw. Fortuna Dam and Chiriquí Grande, 7.3 mi. N of bridge, *T. Croat & M. Grayum 60260* (MO). **Chiriquí:** rd. betw. Chiriquí Grande and Fortuna, 7.7 mi. W of Chiriquí Grande, *T. Croat & M. Grayum 60093* (CM, MO, PMA, RSA). **Coclé:** trail to Las Minas, *P. H. Allen 2462* (US); La Mesa, *T. Croat 14397* (MO); Cerro Pilón, *T. Croat 37340* (MO), *T. Croat 37567* (MO); El Copé, near Continental Divide, *T. Croat 44723* (MO), *B. Hammel 955* (MO), *B. Hammel 1049* (MO), *S. Knapp & R. Dressler 3488* (MO); Llano Grande-Coclecito, N of La Pintada, *T. Croat 49222* (MO); rd. betw. Finca Mandarinas and Finca Furlong, *T. Croat 67194* (MO); Cerro Gaital, *T. Croat 74811* (MO), *G. de Nevers et al. 3509* (MO, PMA), *S. Knapp 5321* (MO), *S. Knapp 5800* (MO); Alto Calvario, *J. P. Folsom 2480* (MO); La Junta-Alto Calvario, *J. P. Folsom 5908* (MO); from La Mesa towards Los Llanos, *J. Luteyn 4104* (DUKE); Llano Grande-Cascajal, NW of Penonome, *K. Sytsma 3844* (MO); Cerro Caracoral, *K. Sytsma 4083* (MO); Cerro Turega, *R. E. Woodson & R. W. Schery 167* (MO). **Colón:** along Río Guanche, *T. Antonio 4810* (MO), *T. Croat 37021* (MO), *G. McPherson 8516* (MO); Cerro Jefe region, Santa Rita Ridge Rd., 10–21 km from Transisthmanian Hwy., *M. Correa 587* (DUKE, MO), *T. Croat 34304* (MO), *S. Knapp & R. Schmalzel 5209* (MO), *S. Knapp & R. Schmalzel 5228* (MO), *G. McPherson 10232* (CM, MO), *S. Mori & J. Kallunki 5058* (MO); Portobelo-Nombre de Dios, Nuevo Tonosi-Río Indio, *T. Croat 33529* (MO, PMA); Portobelo-Río Cascajal, vic. Nuevo Tonosi, *T. Croat 33658* (MO); Portobelo-Nombre de Dios, 10 km W of Nombre de Dios, *S. Knapp & J. Mallet 5686* (MO), *S. Knapp & J. Mallet 5705* (MO); SW of Portobelo, *R. Liesner 1032* (MO); originally collected at Cerro Jefe, cultivated at Univ. of Hawaii, *R. Sheffer 176* (MO), *R. Sheffer 275* (MO); 5–8 km SW of Cerro Bruja, *K. Sytsma et al. 4296* (MO, PMA); Donoso, hacia Valle Grande, *A. Zapata et al. 969* (PMA). **Panamá:** Cerro Azul, *T. Croat 11594* (MO); Cerro Campana, *T. Croat 12161* (MO), *T. Croat 35942* (MO), *P. Hutchinson & R. Dressler 2955* (DAV), *H. van der Werff & J. Herrera 6209* (MO); rd. beyond Su Lin Hotel, *T. Croat 14229* (MO); El Llano-Cartí, 7–20 km from Inter-American Hwy., *T. Croat 25147* (MO), *T. Croat 75141* (CAS, MO), *J. P. Folsom 2564* (MO), *J. P. Folsom & L. Collins 1519* (MO), *S. Hoover 1311* (MO), *R. Liesner 1192* (MO, NY), *S. Thompson 4623* (MO); 3–3.5 mi. NE of Altos de Pacora, *T. Croat 68677* (MO); P. N. Altos de Campana, Buena Vista, *Espinosa et al. 3165* (PMA); Torti Arriba, Rancho Chorro, *J. P. Folsom et al. 6678* (MO); Peluca meteorological station, *H. Kennedy & R. Dressler 2983* (MO); Río Terable valley, *S. Knapp & R. Schlmalzel 5489* (MO); Serranía de Maji, S of Ipeti, *S. Knapp et al. 4485* (B, K, MO). **San Blas:** El Llano–Cartí Rd., Km 19–28, *G. de Nevers & H. Herrera 7248* (CM, K, MEXU, MO, NY), *G. de Nevers et al. 5079* (MO); Río Cangandi, Pueblo Cangandi, *H. Herrera 208* (MO); Nusigandí, *G. McPherson 10788* (MO); Río Acla, Aila Tiwar, *A. Sugden 455* (K, MO). **Veraguas:** Alto Piedra-Río Dos Bocas, 5–8 km from Escuela Agrícola Alto Piedra, *T. Croat 25966* (MO); Santa Fe-Calovebora, Escuela Agrícola Alto Piedra, *T. Croat 49010* (MO), *T. Croat & J. P. Folsom 33969* (MO), *J. P. Folsom & L. Collins 1614* (MO); Santa Fe to Río San Luis, Río Segundo Brazo, *T. Croat 66894* (MO); Río Primero Brazo, 5 mi. NW of Santa Fe, *R. Liesner 819* (MO). COLOMBIA. **Chocó:** E side of Serranía del Darién, approached from Acandí, *A. Juncosa 666* (MO).

Anthurium ternifolium Croat & Carlsen, sp. nov. TYPE: Ecuador. Pastaza: along road betw. Puyo & Baños, vic. of Shell, less than 1 km N of village, 1°29′39″S, 78°3′52″W, 1096 m, 15 Aug. 2002, *T. Croat, L. Hannon & P. Schmidt 86586* (holotype, QCNE; isotypes, B, COL, HUA, K, MO 5735452–5735453 [2], NY, QCA, US, USM, VEN). Figure 3C, D.

Planta terrestris aut epiphytica scandensque, internodiis usque ad 7 cm longis. Folium petiolo semitereti vel D-formi; lamina profunde triloba usque ad [2–]4.0–6.5 cm e basi fissa, lobo medio oblongo-lanceolato gracili, lobis lateralibus falcatis apicibus anguste rotundatis, costis posticis nudis, costa media utrinque acute elevata. Inflorescentia spatha viridi; spadice sessili, viridi, cylindrico aut anguste acuminato.

Terrestrial or climbing epiphyte; internodes up to 7 cm long, 1–1.5 cm diam.; cataphylls drying reddish brown, 4–8 cm long, apex acuminate, decomposing into fibers, persisting at upper nodes. *Leaves* erect; *petiole* (14–)20–34 cm × 3–5 mm, semiterete or D-shaped; geniculum 1–1.5 cm × 3–5 mm; *blades* deeply trilobed to [2–]4–6.5 cm from the base, subcoriaceous, 13–28 × [12–]16–26 cm, dark green, semiglossy above, slightly paler, matte below, raphides visible on upper surface, base cuneate; central lobe oblong-lanceolate, [8.5–]14–26 × [3.5–]5–10 cm, apex acuminate; midrib raised above and below, angled; primary lateral veins 5 to 7 per side, arcuate-ascending, sunken above, raised below, departing midrib at 30°–45°; tertiary veins moderately conspicuous; collective veins arising from one of the lowermost pairs of primary lateral veins, 4–7 mm from the margin, sunken above, raised below; lateral lobes falcate [spreading], 35°–45° [70°–90°] from central lobe, 14–22 × 4–8.5 cm, apex narrowly rounded, inner margin straight to weakly convex, outer margin concave; basal veins 3 to 5 pairs, the first free, the rest joined for 2.5–4 cm; posterior ribs straight to weakly arcuate, 55°–65° from midrib, naked for 1–3 cm. *Inflores-*

cence erect; peduncle 20–35 cm × 2–5 mm, equal or longer than petiole; *spathe* green, lanceolate, reflexed, 4–8 × 0.6–1 cm, apex acuminate, acumen 3–5 mm long, base obtuse, clasping; *spadix* sessile, green, cylindric to narrowly tapered, (3–)5–10(–14) cm long, 4–5 mm diam. at base, ca. 3 mm diam. at apex; 3 to 4 flowers per principal spiral, rhombic, 3–3.5 × 2–2.5 mm, sides sigmoid; tepals semiglossy, lateral tepals ca. 1.5 mm wide, inner margin straight to weakly rounded, then curved upward, outer margin angled; stamens not exserted; anthers ca. 3.5 × 0.5 mm, thecae elliptic, slightly divaricate; pistils emergent just at tepal level; stigma slitlike, ca. 0.5 mm across. *Infructescence* green, 7–14 × 0.7–1.5 cm; fruits green, ovate, ca. 5 × 3–4 mm.

Anthurium ternifolium is endemic to the northeastern slopes of the Andes in Ecuador (Morona–Santiago, Napo, and Pastaza Provinces), growing between 800 and 1700 m in premontane and montane wet forests (Fig. 4A). The species epithet refers to the deeply trilobed leaf blades with the central lobe being almost equal to the lateral ones in width and length.

Anthurium ternifolium is distinguished by its slender, oblong-lanceolate central lobe, semi-terete petiole, midrib acutely raised on both sides, falcate lateral lobes, collective veins 4–7 mm from the margin, and its short, green, sessile spadix.

Anthurium ternifolium can be confused with *A. grex-avium* Madison, which occurs at high elevations in southeastern Ecuador, both having falcate slender lateral lobes, climbing habit, and elongated internodes. However, *A. grex-avium* differs in having just one very conspicuous pair of basal veins, winged posterior ribs, and a stipitate spadix. The leaves of *A. ternifolium* may also resemble juvenile leaves of *A. furcatum* Sodiro, both having naked posterior ribs, falcate lateral lobes, and an oblong central lobe. However, *A. furcatum* is distinct in its primary lateral veins departing the midrib at 60°–70°, in having a stipitate, red-purple spadix, and in occurring on the western slopes of the Andes in Ecuador.

Paratypes. ECUADOR. **Morona–Santiago:** P. N. Sangay, entre Río Sardina y Volcán, *Montalvo & C. Cerón 21* (QAP). **Napo:** carretera Hollín–Loreto, km 25–31, *A. Alvarado 149* (MO), *F. Hurtado & X. Ruiz 1796* (MO), *W. Palacios 4068* (MO); rd. betw. Baeza and Tena, 31–59 km N of Archidona, *T. Croat 49606* (MO), *T. Croat 49626* (MO), *T. Croat 58783* (MO, QCA); 6.7 km W of Río Payamino, 20 km W of Loreto, *T. Croat 72628* (MO); Río Granadillo, Campamento de INECEL, "Codo Alto," *W. Palacios 5512* (MO); Proyecto Hidroeléctrico Coca, Río Quijos, 10 km S de Reventador, *W. Palacios 5892* (MO, QCNE). **Pastaza:** vicinity of Mera, *E. Asplund 18548* (S), *E. Asplund 18574* (S), *E. Asplund 19596* (S), *T. Croat 72829* (MO), *M. Lugo 64* (MO, S), *T. Plowman & E. Davis 4549* (S); vicinity of Shell, *X. Cornejo & C. Bonifaz 1460* (GUAY), *T. Croat 73547* (MO, QCNE); Colonia Isidro Ayora, *G. Harling & L. Andersson 16956* (GB); Puyo–Puerto Napo rd., San José ca. 17 km E of Puyo, *G. Harling & L. Andersson 17115* (GB); 4 km N of Mera, along Río San Jorge and Río Tigre, *B. Øllgaard & H. Balslev 9141* (AAU); 3.5 km W of Mera on road to Baños, *B. Stein 2986* (MO).

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Two New Species of *Encyclia* (Orchidaceae: Laeliinae) from Venezuela

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ABSTRACT. Two new species of *Encyclia* Hooker (Orchidaceae: Laeliinae) are proposed from Venezuela, *E. betancourtiana* Carnevali & I. Ramírez and *E. garciae-esquivelii* Carnevali & I. Ramírez. The first, from Andean Venezuela, is related to *E. aspera*, but has a subquadrate labellum and grows at higher elevations. The second, from the northern slopes of the Coastal Range, is related to *E. diurna* but has smaller, differently colored flowers, a more elliptic central lobe, and grows in coastal thorn forests.

RESUMEN. Dos nuevas especies de *Encyclia* Hooker (Orchidaceae: Laeliinae) de Venezuela se proponen, *Encyclia betancourtiana* Carnevali & I. Ramírez y *E. garciae-esquivelii* Carnevali & I. Ramírez. La primera de estas, de la región andina, está relacionada con *E. aspera*, pero el lóbulo central es subcuadrado y crece a mayores elevaciones. La segunda, de la vertiente norte de la Cordillera de la Costa, está relacionada con *E. diurna* pero tiene flores menores y de colores diferentes, un lóbulo central más elíptico y crece en selvas espinosas costaneras.

Key words: *Encyclia*, Laeliinae, Orchidaceae, systematics, Venezuela.

The genus *Encyclia* Hooker was first treated for Venezuela by Foldats in 1970 (embedded within the genus *Epidendrum* Jacquin). The genus was then reviewed by Carnevali and Ramírez (1988, as *Encyclia*) and later by Carnevali et al. (1994). These last two treatments included within *Encyclia* the species that were recently segregated as the genus *Prosthechea* Knowles & Westcott by Higgins (1998). An overall, encyclopedic view of the South American species of the genus was presented by Withner (2000), who essentially treated the Venezuelan species following Carnevali et al. (1994). This author for the first time explicitly excluded the *Prosthechea* taxa from *Encyclia* in a generic treatment. Romero and Carnevali (2000) added two *Encyclia* species for Venezuela in their new edition of Dunsterville and Garay's *Orchid of Venezuela: A Field Guide*. The *Encyclia* species from the Venezuelan Guayana were recently treated by Carnevali and Ramírez (2003). Among all these treatments, we can account to date for 16 *Encyclia* species in Venezuela. Since there have been several range extensions, circumscription changes, and additions in the genus for the Venezuelan flora, we have started a new study that will deal with these problems to eventually result in a new revision of the genus for the country.

In this paper, in preparation for the larger overview of Venezuelan *Encyclia*, we propose two new species, raising the number of known Venezuelan members of the genus to 18. The first new species, *Encyclia betancourtiana*, is the result of the recent collection of a hitherto unrecorded member of the E. aspera (Lindley) Schlechter group, a complex of Andean members of the genus. The second new species, *Encyclia garciae-esquivelii*, is the result of a study of the variation within the broad circumscription of *E. diurna* (Jacquin) Schlechter taken by previous authors (e.g., Foldats, 1970; Carnevali & Ramírez, 1988; Carnevali et al., 1994).

Encyclia betancourtiana Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Mérida: Mun. Libertador, Parque Nacional Sierra Nevada, valle intramontano en los alrededores de El Morro, a lo largo de los taludes del río Nuestra Señora, ca. 8°27′N, 71°10′W, 1800–2000 m, 20 feb. 2002, *G. Carnevali 6056* (holotype, VEN; isotype, CICY). Figure 1.

Species haec *Encycliae asperae* affinis sed planta parviore, labello lobo centrali subquadrato, lobis lateralibus proportione breviore latiore, petalis latiore paulo basaliter attenuatis, disco altilamellato recedit.

Epiphytic *herbs* 15–20 cm tall; rhizome abbreviated, thus plants ± caespitose with the pseudoulbs clustered but eventually shortly creeping; *pseudobulbs* 2.5–5 × 1.2–2.5 cm, ovoid to (more

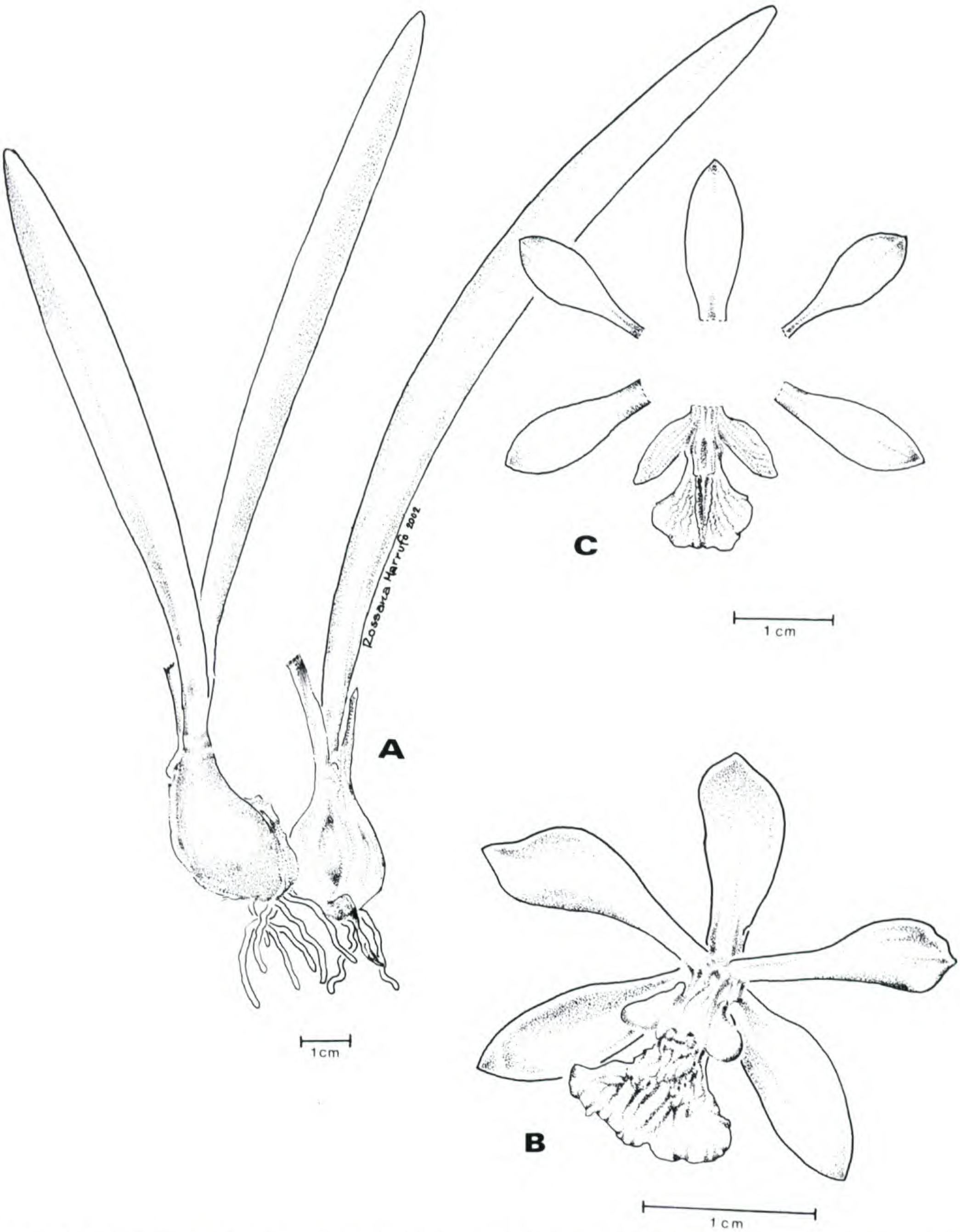

Figure 1. *Encyclia betancourtiana* Carnevali & I. Ramírez. —A. Plant. —B. Flower. —C. Perianth segments, flattened (based on *G. Carnevali 6056* (isotype, CICY), drawn by Rossana Marrufo, CICY).

rarely) ovoid-suborbicular, clothed in 1 or 2 scarious sheaths, apically (1- or)2-leaved. *Leaves* 10–20 × 0.9–1.9 cm, rigidly coriaceous, straight, erect, oblong, obtuse, apex minutely unequal, blade almost flat or slightly concave. *Inflorescence* racemose or with a single, few-flowered branch at base, surpassing the leaves, with 12 to 16 laxly arranged flowers, the flowers spaced 15–40 mm; peduncle and rachis purple-brown tinged, coarsely verruculose; *pedicel* and *ovary* 17.5–19 mm long, ca. 3 mm thick, verruculose, purple-brown tinged. *Flowers* with widely spreading perianth segments, resupinate, petals and sepals dark yellow-green with dark brown suffusion toward apices, labellum with white midlobe and with 2 or 3 purple longitudinal, raised nerves, the apices of the lateral lobes pale yellow-

Figure 2. *Encyclia garciae-esquivelii* Carnevali & I. Ramírez. Flowers (photograph by G. Carnevali, based on *G. Carnevali & I. Ramírez 6811*).

green, the callus white with a few purple nerves, the column apically white, at base pale yellow-green with 3 faint lines of fine purple dots, the anther dull pink with thick, deep dark purple margins; *sepals* 7-nerved, elliptic or oblong-elliptic, obtuse or obtusely acute, the laterals very slightly oblique, more attenuated basally than the dorsal sepal, the apex on the external face with dense verrucae and bluntly keeled; dorsal sepal 15.5–16 × 5.5–6 mm; *petals* 14.8–15.2 × 5–6 mm, 1.5 mm wide at base, 5-nerved, spathulate, obtuse to obtusely acute at apex, apically with a thickened mucro; *labellum* 3-lobed, the lateral lobes parallel and laxly embracing the column, upon spreading forming an angle of less than 45° in relation to the main labelar axis, 14–15 mm long along its main axis, 13–14 mm across the spread lateral lobes, midlobe 8–9 mm long from the point where lateral lobes arise, broadly obovate in general outline including the basalmost, callus-including section; the blade of the midlobe 6–7 × 9.5 mm, transversally subquadrate-rhomboid, broadly truncate and shallowly emarginated or 2-lobed at apex, the upper surface with the nerves keeled and coarsely verruculose with the verrucae arranged in 8 longitudinal lines; lateral lobes 9–9.5 mm long along the external margin (ontogenetically the most basal), 6–6.5 mm long along the internal margin, ca. 3.5 mm wide at base, oblong-elliptic in general outline, 6- or 8-nerved, the lobes decurrent on the disk for 4.7–5 mm; obliquely obtuse to round at apex; disk formed by 4 longitudinal, smooth plates or broad keels, the 2 central ones fused in an elevated almost flat, oblong plate, 6–6.5 mm long, the plate tridentate at apex and with a shallow, narrowly elliptic longitudinal depression in the central portion; the 2 outermost keels much lower and divergent centrally; the callus barely extending into the lower half of the central lobe; *column* 7–7.9 mm long, ca. 3.5 mm wide at apex where it expands and gradually and slightly attenuates toward base where it is 3 mm wide, somewhat pandurate in outline; just below apex provided with 2 small wings, 0.9–1.1 mm long, these narrowly triangular, acute, in natural position bent toward the labellum and very laxly holding it in position; stigmatic surface ca. 2 × ca. 2.5 mm wide, obcordate; the clinandrium with 3 shallow teeth, the central ca. 0.2 mm long; anther subquadrate in general position, ca. 1.5 mm long. *Capsules* unknown.

Encyclia betancourtiana belongs to an Andean complex of *Encyclia* characterized by coarsely verruculose peduncles, rachis, and ovaries. These *Encyclia* species also feature thick, elevated, more or less flat calli with the central depression less de-

veloped than in other groups of the genus. Furthermore, the keel or nerves that emerge from the callus and extend into the midlobe of the labellum are thick and usually coarsely verruculose. The auricles or wings of the column are also relatively small and usually acute. The capsules are verruculose to warty in other species of the complex and so, probably, are those of the newly proposed species. This Andean complex includes such taxa as *Encyclia aspera* (sensu Withner, 2000, including as synonyms *E. trachypus* Schlechter and *E. asperirachis* Garay), *E. angustiloba* Schlechter, *E. microtos* (Reichenbach f.) Hoehne, and probably *E. naranjapatensis* Dodson, which range from Peru to Colombia, mostly along the western declivities of the Andes, although *E. microtos* is also known from the eastern drainages in Peru. Some species of this Andean complex also feature reddish peduncles and rachises similar to the purple-brown ones seen in *E. betancourtiana*. *Encyclia betancourtiana* is the first member of this complex to be recorded from the Cordillera de Mérida and for Venezuela.

Among the species of this Andean complex, *Encyclia betancourtiana* can be diagnosed by its transversely subquadrate-rhomboid central lobe of the labellum (vs. orbicular or orbicular-elliptic in *E. aspera*), and the lateral lobes are proportionally shorter (barely projecting beyond the apex of the column in natural position vs. conspicuously longer than the column in *E. aspera*), broader, and apically blunter (vs. narrow and acute in *E. aspera*). It also grows at much higher elevations than *E. aspera*.

It is interesting to note that *Encyclia betancourtiana* has essentially the same labellum outline as *E. andrichii* Menezes, a species from Espírito Santo, Brazil. In *E. betancourtiana*, however, the leaves are proportionally broader (to 10.5–11 times longer than wide vs. ca. 12.5 times as long as wide in *E. andrichii*) and the labellum has fewer raised, colored nerves. We have not seen authentic material of *E. andrichii*, but assume the two taxa not to be closely related on account of the biogeographical disjunction.

Encyclia betancourtiana is apparently rare and geographically localized. At present, it is only known from a few epiphytic plants collected on trees over cliffs along the Nuestra Señora River, one of the most important rivers of Parque Nacional Sierra Nevada. These plants were brought into cultivation in the year 2001, and a few of them flowered in 2002. The type material was prepared from these inflorescences. The plants seem to thrive under cultivation but are difficult to bring into flower.

Eponymy. We take great pleasure in naming this species after Armando and Armando Dimas Betancourt, amateur orchid growers from Venezuela, who first collected and flowered this species. They also provided the type material.

Encyclia garciae-esquivelii Carnevali & I. Ramírez, sp. nov. TYPE: Venezuela. Aragua: unos 1–2 km al oeste de la cumbre de la carretera entre Ocumare de la Costa y Cata, unos 4–5 km al E de la Ocumare de la Costa, 10°29′N, 68°42′W, Parque Nacional Henry Pittier, en la vertiente norte de la Cordillera de la Costa, 300–400 m; flowering under cultivation by G. Carnevali & I. M. Ramírez in Mérida, Yucatán, México, 10 June 2003, specimens prepared from plants collected by G. Carnevali in 1986, *G. Carnevali & I. Ramírez 6811* (holotype, VEN; isotypes, AMES, CICY, MEXU, MO, NY). Figures 2, 3.

Species haec *Encycliae diurnae* affinis sed planta et floribus parvioribus, pseudobulbis 2–3-foliatis, petala sepalaque brunneis vel viridibrunneis proportione angustiore, labello lobo apicali proportione angustiore (1.8 longiore quam latiore vs. 1.1–1.3 latiore quam longiore) apice truncato vel paulo emarginato vel truncato (vs. rotundato) recedit.

Epiphytic or lithophytic *herbs* 25–40 cm tall not counting the inflorescences; rhizome abbreviated, thus plants caespitose with the pseudobulbs clustered, clothed in scarious sheaths; *pseudobulbs* suborbicular to suborbicular-pyriform, 3–5 × 3–3.5 cm, slightly less thick, apically 2- to 3-leaved, clothed by 2 to 3 scarious sheaths that soon disintegrate. *Leaves* 20–29 × 1.8–2.2 cm, linear oblong, acute, apex minutely unequal, margins revolute, blades often twisted 90°–180°. *Inflorescences* 27–70 cm long, erect, paniculate with 1 to 5 lateral branches, lateral branches 6–8 cm long, 2- to 6-flowered, peduncle terete, relatively thin and wiry, to 2 mm thick at base, bearing 2 or 3 tubular, closely fitting sheaths at lowermost internodes, the sheaths 14–16 mm long, peduncle and rachis dull brown-purple, ± densely verruculose, the verrucae creamy white to green, 0.2–0.3 mm diam.; *floral bracts* ca. 1 mm long and wide, broadly ovate, apiculate, sub-fleshy when fresh, dark maroon along and around midnerve, otherwise green. *Flowers* resupinate, with widely spreading perianth segments, sweetly fragrant, sepals and petals dull pale green, dull brown-maroon suffused, suffusion lighter toward the margins, particularly in the petals, the labellum with white midlobe with 7 entire or partially broken longitudinal purple nerves at each side of the midnerve, the lateral lobes cream white with purple-brown longitudinal nerves on the basal half, clear white on the apical half, the disk basally

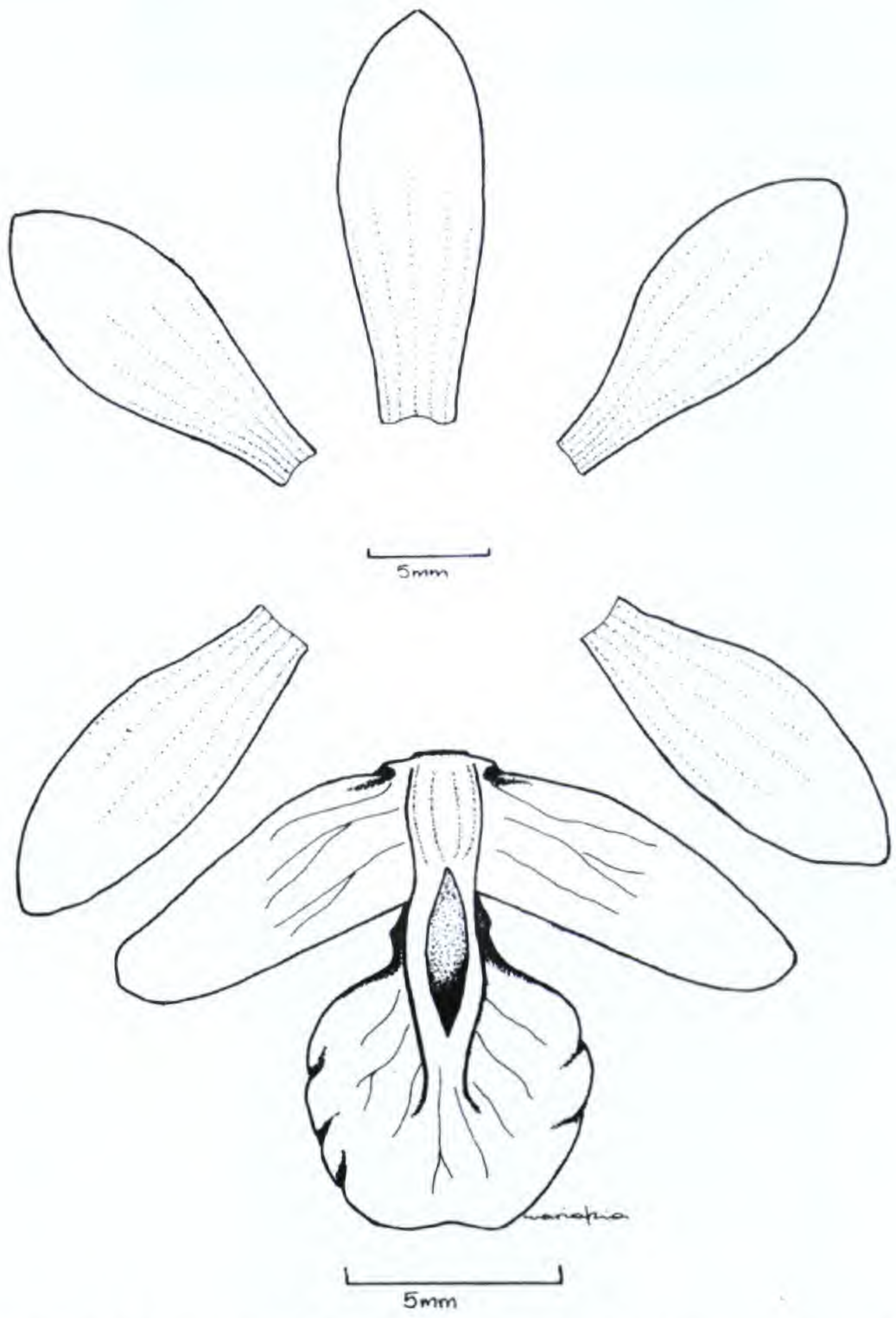

Figure 3. *Encyclia garciae-esquivelii* Carnevali & I. Ramírez. Perianth segments, flattened (based on *G. Carnevali 2011* (VEN), drawn by María Pía Bevilacqua, VEN). Both scales = 5 mm.

green, the callus white with some pink suffusion at base and five faint red-purple nerves on the lower half, column cream white at apex, green at base with some faint purplish or maroon suffusion on the adaxial surface on the lower half; *sepals* flat or slightly concave, the dorsal ones 14.5–16 × 4.8–5 mm, elliptic-lanceolate, obtuse, 9-nerved, the laterals 15–15.5 × 6 mm, elliptic-lanceolate, obtuse, slightly oblique, 11-nerved; *petals* 15–16 × 5–5.2(–6.5) mm at their widest, attenuated below the middle and 1–2 mm wide at base, apically concave, spathulate-elliptic, apically obtuse, minutely apiculate, thick, 5-nerved at base, 7-nerved apically; *labellum* 3-lobed, the lateral lobes tightly embracing the column, upon spreading forming an angle of less than 45° relative to the main labellar axis, the labellum 15.5–16.5 mm total length along its main axis, 14.5–15.3 mm wide across spread lateral lobes; *midlobe* 8–9 mm long from the point where lateral lobes arise, broadly elliptic in general outline including the basalmost, callus-including section, the blade 7.6–7.8 mm long, suborbicular to elliptic-suborbicular, truncate to shallowly emarginate at apex; lateral lobes 6.5–7.5 mm long along the external margin (ontogenetically the most basal), 5.5–6.5 mm long along the internal margin, ca. 3–4 mm wide at base, sub-triangular to triangular oblong in general outline, 8-nerved, the lobes decurrent on the disk for 4.5–4.8 mm, obliquely round to truncate at apex where they are ca. 2 mm long; disk formed by four longitudinal, smooth plates or broad keels that run parallel at base, the two outermost lower while the higher, central ones diverge at above the point of emergence of the lateral lobes to converge again at the base of the midlobe to form an elliptic depression ca. 2 mm long, the callus extending into the lower half of the central lobe; *column* 8.7–9.2 × ca. 3 mm wide at apex where it expands and from where it gradually attenuates toward base, just below apex provided with two small wings, 0.9–1.1 × ca. 0.5 mm wide, the wings oblong, apically rounded, in natural position bent toward the labellum and holding it in position (tightly appressed to the column); stigmatic surface ca. 2 mm long, obovate-obcordate; anther sub-rounded in general position, ca. 2 mm long and wide; the clinandrium with 5 shallow teeth. *Pedicel* and *ovary* 15–17 mm long, 3 mm diam., subterete, thickened on the upper half, pale greenish yellow on the lower half, above darker, maroon-suffused green, verruculose, the verrucae similar to those of the peduncle and rachis but somewhat smaller and more laxly arranged; capsules ellipsoid, verruculose.

Encyclia garciae-esquivelii is closely related to *E. diurna* (Jacquin) Schlechter and has long been thought to be only a variant of it. It was first noted as potentially distinctive (under *E. diurna*) by Carnevali and Ramírez (1988). It is distinct enough, both morphologically and ecologically.

The plants of *Encyclia garciae-esquivelii* are smaller with proportionally shorter leaves (mature leaves 25–30 cm long in *E. garciae-esquivelii* vs. exceeding 50 cm in *E. diurna*). Pseudobulbs are often 3-leaved in *E. garciae-esquivelii,* while they are almost always 2-leaved in *E. diurna.* The inflorescences are usually much shorter in *E. garciae-esquivelii* than in *E. diurna* (usually longer than 1 m in fully mature plants) and the flowers are conspicuously smaller (dorsal sepal 14.5–16 mm long in *E. garciae-esquivelii* vs. 21–24 mm long in *E. diurna*). The central lobe of the labellum in *E. garciae-esquivelii* is broadly elliptic and apically truncate, while the same structure is orbicular and apically rounded in *E. diurna,* thus proportionally narrower (1.8 longer than wide in the new species as opposed to 1.1–1.3 times longer than wide in *E. diurna*). A most striking difference lies in the coloration of the flowers, since the petals and sepals of *E. garciae-esquivelii* are dull pale green, with dull brown-maroon suffusion, while they are invariably green in true *E. diurna.* The raised nerves in the labellum of *E. diurna* are a faint dull purple, while they are a deeper purple hue in the new species.

Besides these morphological differences, *Encyclia garciae-esquivelii* is biogeographically distinct from *E. diurna.* While *E. diurna* grows at elevations of (600–)800–1500 m mostly on the southern slopes of the Coastal Range in areas of cloud forests or premontane rain forests, *E. garciae-esquivelii* is an inhabitant of low-lying, xeromorphic vegetation along the coast at elevations of less than 100 m, often at sea level.

Encyclia garciae-esquivelii is a possibly rare, poorly collected species, known from two sets of populations, one in central coastal Venezuela, where they occur as low epiphytes or lithophytes in tropical thorn forests of north-(sea)facing slopes, along the roads from Ocumare de la Costa and Cata, and also along the road from Cata to Cuyagua. The second known population is from northeast-oriented, sea-facing cliffs near Chichirivichi in Falcón, probably 80–100 km northwest of the first set of populations, but in similar vegetation. The species, although possibly rare, is probably composed of several dispersed populations widespread along the xerophytic belt associated with the coast of north-central Venezuela.

Where known, *Encyclia garciae-esquivelii* is commonly associated with orchid taxa common to coastal thorn forests such as *Brassavola nodosa* (L.) Lindley, *Encyclia cordigera* (HBK) Dressler, *Myrmecophila humboldtii* (Reichenbach f.) Rolfe, and *Oncidium baueri* Lindley. These forests commonly feature columnar cacti in several genera (*Subpilocereus, Pilosocereus, Praecereus*), and herbaceous or succulent species such as *Pitcairnia, Peperomia, Melocactus, Anthurium* (especially members of sect. *Pachyneurium*), and *Bromelia chrysantha* Jacquin. The low canopy is dominated by spiny legumes.

An additional population of related encyclias, represented by the collection *Carnevali 3203* (CICY, VEN), remains a mystery. This population comes from Sierra Imataca, in Bolívar State in southeastern Venezuela. The cultivated plants of this population grown at the Caracas Botanical Garden came without more precise data. This population was treated by Carnevali and Ramírez (2003) as part of a broadly conceived *Encyclia diurna.* The authors then expressed their misgivings as to this hypothesis of relationships. This population is similar to *E. garciae-esquivelii,* but has a broader, more rounded central lobe to the labellum, and the apices of the lateral lobes are more rounded and reflexed in natural position. Otherwise, it conforms with *Encyclia garciae-esquivelii.* It may represent an additional undescribed species in the E. diurna complex or a distinctive population of *Encyclia garciae-esquivelii.* The Guayanan locality, however, suggests this population may belong to a different species than *E. garciae-esquivelii.* Thus, until more material is collected (to assess ranges of variation) and more precise locality data are available, we refrain from proposing an additional novelty.

Paratypes. VENEZUELA. **Aragua:** unos 1–2 km al oeste del la cumbre de la carretera entre Ocumare de la Costa y Cata, unos 4–5 km al E de la Ocumare de la Costa, 10°29′N, 68°42′W, Parque Nacional Henry Pittier, en la vertiente norte de la Cordillera de la Costa, 300–400 m, flowering under cultivation in Maracay, Edo. Aragua, 19 June 1994 (*G. Carnevali 3668,* VEN); flowering in cultivation, 1 July 1986, *G. Carnevali 2011* (CICY, pickled; VEN). **Falcón:** Dist. Silva, a lo largo del borde sur del Golfete de Guare, al pie de las escarpas calcáreas que miran al norte, SW de Chichiriviche, W de la Cueva de los Indios, 1–4 m, 10°54′–55′N, 68°17′–19′W, 31 Aug. 1974, *J. A. Steyermark & B. Manara 110489* (NY, VEN); flowering in cultivation at the Caracas Botanical Garden, 21 July 1993, *G. Carnevali 3204* (CICY, pickled; VEN).

Etymology. We are pleased to honor Carlos García-Esquivel of Caracas, Venezuela, with this species. Dr. García-Esquivel, a psychiatrist, is a world-renowned orchid species grower and one of the most knowledgeable Venezuelans in orchid

matters. He has collected widely in the country and has already been honored by several orchid names. These include such orchids as *Masdevallia garciana* Luer, *Epidendrum garcia-esquivelii* L. Sánchez & Hagsater, *Pleurothallis garciana* Luer, and others. The name *Encyclia garciana* is preoccupied by *E. garciana* (Garay & Dunsterville) Carnevali & I. Ramírez [basionym: *Epidendrum garcianum* Garay & Dunsterville = *Prosthechea garciana* (Garay & Dunsterville) W. Higgins] that preempted us from using only the first of Dr. García's last names.

The epithet choice "*garciae-esquivelii*" is allowed by article 23.5 of the *International Code of Botanical Nomenclature* (Greuter et al., 2000) as a genitive noun. The hyphen is deliberate and supported by Article 60.9., ex. 17.

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A New Vining Species of *Swartzia* (Fabaceae, Swartzieae) from the Venezuelan Amazon

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ABSTRACT. *Swartzia barnebyana*, a new legume species with a vining habit from the state of Amazonas in Venezuela, is described and illustrated. The new species belongs to section *Possira*, series *Unifoliolatae*, in which it is closely related to both *S. floribunda* Spruce ex Bentham and *S. iniridensis* R. S. Cowan, by its intramarginally interconnected primary veins and its densely strigulose-velutinous pubescence on branchlets, inflorescence axes, and external calyx segments. *Swartzia barnebyana* may be distinguished from both related species mainly by the type and color of the ovary pubescence, shape and size of leaflet blades, number of calyx segments, and absence of pubescence in the internal surface of the calyx.

RESUMEN. Se describe e ilustra *Swartzia barnebyana*, una especie nueva de leguminosa con hábito trepador del estado Amazonas, Venezuela. La especie nueva pertenece a la sección *Possira*, serie *Unifoliolatae* dentro de la cual se relaciona estrechamente con *S. floribunda* Spruce ex Bentham y *S. iniridensis* R. S. Cowan por las venas primarias interconectadas intramarginalmente y la pubescencia densamente estrigulosa-velutina sobre ramitas, eje de las inflorescencias y segmentos externos del cáliz. *Swartzia barnebyana* se distingue de las especies relacionadas, principalmente por el tipo y color de la pubescencia en el ovario, la forma y tamaño de la lámina de los folíolos, el número de segmentos del cáliz y la ausencia de pubescencia en la superficie interna del cáliz.

Key words: Fabaceae, section *Possira*, series *Unifoliolatae*, *Swartzia*, Venezuelan Amazon.

During preparation of the treatment of *Swartzia* Schreber for the *Flora of the Venezuelan Guayana* (Cuello & Cowan, 1999), a number of undetermined taxa were set aside for further study. One of these, represented in the mentioned treatment as "Swartzia sp. E" (1999: 405), turns out to be an undescribed species for which a name and description are provided in this article.

Swartzia barnebyana Cuello, sp. nov. TYPE: Venezuela. Amazonas: Atures, Serranía Batata, 55 km al SE Puerto Ayacucho, 2 km al NE de Salto Colorado, Caño Colorado sobre corazas lateríticas, 5°33′N, 67°08′W, 550 m, Oct. 1989 (fl), *Elio Sanoja, Angel Fernández & Manuel Yánez 3371* (holotype, PORT; isotypes, MO, VEN). Figure 1.

Haec species venis primariis prope marginem conjugatis atque ramulis inflorescentiae axibus et calycis segmentis extus dense velutinis ad *Swartzia floribundam* et *S. iniridensem* comparabilis, sed a prima foliolis margine planis (nec revolutis) et ovario ventraliter pubescente (nec glabro), a secunda ovario in uno margine barbato trichomantibus infuscatis (nec sericeo), ab ambabus calycis segmentis intus glabris et foliolis multo majoribus diversa.

Vine or sarmentose tree; branchlets terete, densely strigulose-velutinous; stipules caducous, 3–4 mm long, narrowly lanceolate, acute, densely pilose-velutinous; leaves unifoliolate, petioles 5–6 mm long, densely strigulose, stipellate apically, stipels caducous, 1–1.5 mm long, subulate to triangular, petiolules 3–5 mm long, 3–5 mm wide, densely pilose-velutinous, leaflet blades broadly oblong (18–)24–40 × 9–14 cm, the margin plane, the base rounded, the apex obtuse to acuminate, the acumen 12–15 mm long, glabrous on upper surface, densely strigulose to glabrescent beneath with the base of the costa densely strigulose beneath, the costa impressed, the primary veins plane on the upper surface, costa and primary veins salient beneath, the primary veins interconnected intramarginally. Inflorescences axillary racemes, sometimes secondarily becoming branchlets with young leaves, also bearing axillary racemes, axes 5–10 × 0.2–0.4 cm, densely strigulose-velutinous, brown, bracts persistent, 3–6 × 1.5–2 mm, triangular to lanceolate, sometimes developing into leaves with blades 2–3 × 1–1.2 cm; pedicels at anthesis 15–20 mm long, in flower buds 7–15 × 1.5–2 mm, densely strigulose-velutinous. Flower buds ovate-oblong in outline, 9–10(13) mm long, 7–8(10) mm wide, densely strigulose-velutinous; calyx segments 5, persistent, densely strigulose-velutinous exter-

Figure 1. A portion of a branch of *Swartzia barnebyana* Cuello with inflorescences. (Drawn from the type *Sanoja, Fernández & Yánez 3371.*)

nally, glabrous within; petal white, the claw 4–5 mm long, the blade orbicular, 15–17 mm diam., glabrous; larger stamens 3, the filaments white, 15–18 mm long, the anthers yellow, 4–5 mm long, ca. 2 mm wide, oblong-lanceolate, medium-sized stamens 2, opposite the larger stamens, the filaments 12–14 mm long, the anthers 2–3 mm long, ca. 1 mm wide, the smaller stamens ca. 220, the fila-

Table 1. Characters that distinguish *Swartzia barnebyana* from its closest relatives.

	S. barnebyana	*S. iniridensis*	*S. floribunda*
Habit	sarmentose tree or vine	tree 3–4 m	shrub 1.5–3 m
Inflorescence axes	2–4 mm wide, densely strigulose-velutinous, dark brown	1–2 mm wide, densely velutinous, sericeous	2–3 mm wide, densely strigulose-velutinous, light brown
Bracts	triangular to lanceolate, 3–6 mm long	lanceolate, ca. 1.5 mm long	linear, 1.5–2 mm long
Pedicels	15–20 mm long	9–15 mm long	(6)10–15 mm long
Anthers of small stamens	oblong, apex emarginate to slightly mucronate, 1–1.2 mm long	oblong to lanceolate	oblong-ovate, apiculate, 1–2 mm long
Ovary stipe	11–17 mm long	ca. 9.5 mm long	9–15 mm long

ments 8–10 mm long, the anthers oblong, with the apex emarginate to slightly mucronate, 1–1.2 mm long, ca. 0.5 mm wide; gynoecium with the ventral suture barbate, glabrous elsewhere, stigma punctiform, style 4–6 mm long, ovary elliptic-obovate, laterally flattened, 6–8 mm long, 3.5–5 mm wide, ovary stipe white, 11–17 mm long. Fruits not seen.

Distribution and ecology. *Swartzia barnebyana* is known only from the type and paratype collections. According to information recorded on specimen labels, the new species is a small vining tree or vine occurring in nonflooded forests at 500–600 m elevation in Caño Colorado in the Serranía Batata, which belongs to the Cuao-Sipapo massif in the Venezuelan Amazon. It has been collected in flower during September and October.

The genus *Swartzia* comprises about 150 species distributed in two sections, *Swartzia* Cowan and *Possira* (Aublet) DC., according to Cowan (1967). *Swartzia barnebyana* belongs in Cowan's (1967) section *Possira*, series *Unifoliolatae*, based on its axillary inflorescences, simple racemes, the presence of bracts that are obviously reduced leaves, sometimes with leaflets evident, and unifoliolate leaves.

Due to its intramarginally interconnected primary veins and its densely strigulose-velutinous pubescence on branchlets, inflorescence axes, and external calyx segments, the new species *Swartzia barnebyana* is clearly related to both *S. floribunda*, from the Venezuelan Amazon, and *S. iniridensis*, from Colombia (Cowan, 1967). In contrast to the glabrous gynoecium of *S. floribunda*, the new species, like *S. iniridensis*, has the ventral part of the ovary pubescent. The ovary pubescence in the new species consists of sparse barbate brown hairs, while in *S. iniridensis* it is densely appressed sericeous. The new species also differs from the two mentioned relatives by the glabrous inner surface of the 5-segmented calyx. In contrast, *S. floribunda* has a calyx with 4 to 6 segments, villose but glabrescent within, and *S. iniridensis* has 4 segments, sericeous within. Additionally, *S. barnebyana* has the blades of the unifoliolate leaves broadly oblong and much larger [(18)24–40 × 9–14 cm] than the oblong to elliptic-oblong leaflets of both *S. floribunda* [(8)10.5–19(24) × 3.5–6(9) cm] and *S. iniridensis* [16–22 × 5.5–8 cm]. Also, *S. barnebyana* has plane leaflet margins and *S. floribunda* has revolute margins. Other features considered relevant in distinguishing *S. barnebyana* from the related species are shown in Table 1.

The combination of vining or sarmentose habit and unifoliolate leaves suggests a superficial relationship between the new species and *Swartzia palustris* Barneby of the Venezuelan Amazon (Barneby, 1991); however, *S. barnebyana* differs greatly from *S. palustris*, which has glabrate branches and densely golden sericeous inflorescences. The latter species also has smaller, differently shaped leaflets, smaller, ovate bracts (scarcely 1 mm long), smaller globose flower buds (4–5 mm diam.), and a shorter ovary stipe, among other differences.

I am honored to name this species after Rupert Barneby, a great gentleman who dedicated much of his life to the study of legumes and contributed greatly to our knowledge of the genus *Swartzia* in the Venezuelan Guayana.

Paratype. VENEZUELA. **Amazonas:** Atures, Serranía Batata, 55 km al SE de Pto. Ayacucho, 2 km al NE de Salto Colorado, Caño Colorado sobre corazas lateríticas, 5°33′N, 67°08′W, 550 m, Sep. 1989 (fl), *Elio Sanoja, Angel Fernández & Manuel Yánez 3200* (PORT, MO, VEN).

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New Combinations in South American Phaseolinae: *Dolichopsis* and *Macroptilium* (Fabaceae: Phaseoleae)

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ABSTRACT. The new combination *Dolichopsis ligulata* (Piper) A. Delgado is made from *Phaseolus ligulatus* Piper. This species is readily distinguished from *Dolichopsis paraguariensis* by its presenting the beak of the keel with a sigmoid curvature and by its western distribution in Bolivia and adjacent Paraguay. The new combination *Macroptilium ecuadoriense* (Hassler) L. Torres-Colín & A. Delgado is made from *Phaseolus atropurpureus* Sessé & Mociño ex DC. var. *ecuadoriense* Hassler, with *Phaseolus affinis* newly synonymized. Red petals borne from a tubular calyx and presence of hairs in its wing petals readily distinguish *Macroptilium ecuadoriense* from the common and widespread *Macroptilium atropurpureum* with its deep maroon petals borne from a campanulate calyx and glabrous wing petals.

Key words: Chaco, *Dolichopsis*, Ecuador, Fabaceae, *Macroptilium*, Pantanal, Phaseoleae, Phaseolinae, *Phaseolus*.

The native New World subtribe Phaseolinae comprises nine genera: *Dolichopsis* Hassler, *Macroptilium* (Bentham) Urban, *Mysanthus* G. P. Lewis & A. Delgado, *Oryxis* A. Delgado & G. P. Lewis, *Oxyrhynchus* Brandegee, *Phaseolus* L., *Ramirezella* Rose, *Strophostyles* Elliott, and *Vigna* Savi. Of these, the most diversified in terms of species is *Phaseolus*, and in the past, several species of different extant genera were originally described under it. During a phylogenetic study of *Phaseolus* (Delgado-Salinas et al., 1999), it became evident that the taxonomy of most genera needed to be worked out, and thus, the nomenclature of some requires changes, as follows:

DOLICHOPSIS HASSLER

The genus *Dolichopsis* as currently known comprises one species, *Dolichopsis paraguariensis*. This species was described by Hassler (1907), and subsequent collecting suggested that it was somewhat broadly distributed in northern Argentina, Paraguay, Bolivia, and southwestern Brazil. *Dolichopsis paraguariensis* is ecologically and geographically unique among species of Phaseolinae by being restricted to inundated areas of the Chaco and adjacent wetlands, such as the Pantanal, Mato Grosso, and the Tucumán-Bolivian forest, and Ixiamas (Ramella & Spichiger, 1989). Combined morphological and molecular sequence analyses from both nuclear and chloroplast genomes (ITS region and *trn*K locus; e.g., Riley-Hulting et al., 2004), however, have revealed two distinct species from among these specimens of *Dolichopsis paraguariensis*. One of these is referred to as *Phaseolus ligulatus*, which was described by Piper (1926). After reviewing Burkart's (1944) complete description and figure of *Phaseolus dolichicarpus*, this species was determined to be conspecific with *Phaseolus ligulatus*. Thus, the following nomenclature and taxonomy are provided to account for these new discoveries.

Dolichopsis ligulata (Piper) A. Delgado, comb. nov. Basionym: *Phaseolus ligulatus* Piper, Contr. U.S. Natl. Herb. 22: 676. 1926. TYPE: Bolivia. Ixiamas, altitude 240 m, 19 Dec. 1921, *M. Cárdenas 2000* (holotype, US; isotype, MICH).

Phaseolus dolichicarpus Burkart, Darwiniana 6: 487. 1944. Syn. nov. TYPE: Paraguay. Valenzuela (entre Villa Rica y Asunción), campos-esteros (pantanosos), mar. 1942, *T. Rojas 9537* (holotype, SI not seen).

Although Piper (1926) stated that the type collection of *Phaseolus ligulatus* was made by Orland E. White, the labels on both the holotype and isotype indicate that the collector was Martín Cárdenas (his number 2000). According to Rusby (1927), both botanists collected together at Ixiamas. This is further indicated by Rusby (1927: 272), who described *Mascagnia macrophylla* from a collection at Ixiamas by *M. Cárdenas* (his no. 1943) on 18 December 1921, and *Dianthera graminifolia* (1927: 367) from a collection at the same locality by *O. E. White* (his no. 2310), collected on 19 December 1921.

The habit, foliage, and fruit of *Dolichopsis ligulata*, and to a lesser extent the inflorescence, are

similar to those of *D. paraguariensis*. The flowers of the two species, however, differ in a number of features. Most noticeably, the keel petals of *D. ligulata* have a beak that is loosely and somewhat sigmoidally curved, and the style enclosed within has an identical curvature, is distally thickened, and bears a highly compact pollen brush 2 mm long. In contrast, the incurved and upwardly ascending keel in *D. paraguariensis* encloses a style that is distally tapered and bears a loose pollen brush for well over 2 mm long. The stigma is terminal to oblique in both species, but positioned toward the front of the flower in *D. paraguariensis* due to style rotation. In *D. ligulata*, the style rotates laterally toward the right side of the flower. The fruits of both *Dolichopsis* species are broad, about 1 cm wide, and laterally compressed. The seeds are transversely oriented to the fruit length at maturity, rendering a flattened and wider pod that is distinctly unlike any other pod in the subtribe Phaseolinae.

Distribution and habitat. *Dolichopsis ligulata* occurs in Bolivia and adjacent western Paraguay, and inhabits savannas or shrublands, usually in mud or standing water around the margins of seasonal or semi-permanent ponds often associated with grasses, sedges, and such species as *Tabebuia insignis*. Flowering takes place from September to March, during the rainy season. Whereas plants of *D. paraguariensis* can be found in the same ecological setting as *D. ligulata*, there have been no reports of sympatry.

Specimens examined. BOLIVIA. **Beni:** Prov. Yacuma, Estación Biológica del Beni, cerca de la Laguna Normandia, 19 Aug. 1991, *Beck 18853* (NY); alrededor del Porvenir, 21 Sep. 1997, *Beck 24296* (MEXU); near Lake Rogagua, 4 Nov. 1921, *Rusby 1639* (NY). PARAGUAY. **San Pedro:** Alto Paraguay, Primavera, 14 June 1959, *Woolston 1097* (NY).

Macroptilium (Bentham) Urban

The genus *Macroptilium* comprises 18 species distributed from the southwestern United States to northern Argentina. The species are mainly climbers or creeping herbs, often confined to tropical and subtropical habitats. Fifty-five percent of all taxa are endemic to South America (Torres-Colín, unpublished).

Macroptilium is characterized in part by an indumentum of simple hairs, inflorescences with nectariferous nodes, fascicles of bracts at the base of the inflorescence, caducous floral bracts and bracteoles, corollas with conspicuous large wing petals, the left-handed one occupying the position of the standard, and keel petals with an incurved, distally hooked beak. In contrast, the closely related genus *Phaseolus* differs in all of these regards, from uncinate hairs and non-nectariferous inflorescence nodes, to persistent floral bracts and laterally coiled keel beaks. Since Urban (1928) raised *Phaseolus* sect. *Macroptilium* to the generic level, species of *Phaseolus* continue to be reassigned to *Macroptilium* in both hemispheres. Recently, two new combinations have been proposed, one in South America (Drewes & Palacios, 1994), and another in Mexico (Delgado-Salinas & Torres-Colín, 1995). While preparing floristic treatments of *Macroptilium* for different regions of the Americas, a noteworthy species still referred to *Phaseolus* has been brought to our attention, and it has become evident that there is a need to propose a new combination.

Macroptilium ecuadoriense (Hassler) L. Torres-Colín & A. Delgado, comb. et stat. nov. Basionym: *Phaseolus atropurpureus* Sessé & Mociño ex DC. var. *ecuadoriensis* Hassler, Candollea 1: 458. 1923. TYPE: Ecuador. Chimborazo: Riobamba, "In arenosis lapidosis (Tamaúte). Puela," *R. Spruce 5791* (lectotype, designated by Piper (1926: 458), K; isotypes, F, G, NY, W not seen).

Phaseolus affinis Piper, Contr. U.S. Natl. Herb. 22: 682. 1926. Syn. nov. TYPE: Ecuador. Tungurahua: El Tambo, vicinity of Ambato, May 1919, *A. Pachano 248* (holotype, NY; isotypes, 01234494 & 01044710, US photo at MEXU).

While revising the South American species of *Phaseolus*, Hassler (1923) proposed a new variety of *Phaseolus atropurpureus* Sessé & Mociño ex DC. from Ecuador. His description (1923: 458) of *P. atropurpureus* var. *ecuadoriensis* was based on three specimens (*Spruce 5791*, *Jameson 876*, *877*) without the designation of a holotype. Piper (1926: 682) later described *Phaseolus affinis* based on *Pachano 248*, suggesting a resemblance to *P. atropurpureus* and *P. longipedunculatus*, now both species in *Macroptilium*. However, Piper noted without further specification that his new species *P. affinis* could be distinguished from these two taxa now in *Macroptilium* by characters of foliage and calyx, and by the larger flowers. Piper (1926) examined all three syntypes cited by Hassler and designated *Spruce 5791* as the type of *P. atropurpureus* var. *ecuadoriensis* Hassler, listing it as examined under *P. affinis*. His action thus implied that *Phaseolus affinis* and *P. atropupureus* var. *ecuadoriensis* were conspecific. Concerning the nomenclature of both taxa, Article 11.2 of the ICBN (Greuter et al., 2000) indicates that a name of a variety such as the name *ecuadoriensis* has no priority outside its rank; thus

Table 1. Morphological comparison of *Macroptilium atropurpureum* and *M. ecuadoriense*.

	M. atropurpureum	*M. ecuadoriense*
Leaf petiole length (cm)	1.5–8	1–4
Leaflet length (cm), coloration, and indumentum	1.7–9; upper surface green, lower surface canescent	2–3.9; both surfaces green, strigose
Peduncular bract length (mm)	up to 90	40–45
Inflorescence length (cm)	8–45	15–35
No. of flowers per inflorescence	10 to 36, sparse throughout axis	5 to 10, clustered distally
Persistence of bracts and bracteoles	mostly caducous in anthesis	persistent through anthesis
Calyx shape, length (mm), indumentum, and teeth size	campanulate, 50–90, canescent; teeth shorter than calyx tube	tubular, ca. 75, hispid, ferrugineous; teeth longer than the calyx tube
Flower length (cm) and coloration	1.5–3, corolla deep maroon red	ca. 2.5, corolla red
Wing-petal indument	absent	present
Ovule no.	ca. 13	ca. 10
Fruit length (cm)	6–11	6–7
Pollen	prolate-spheroidal; apocolpium punctuated to foveolate, mesocolpium microreticulate; muri width ca. 0.72 μm	perprolate; apocolpium & mesocolpium punctuate; muri width 1–1.5 μm

Piper's selection of the name *affinis* was suitable at that time and valid.

Although Maréchal et al. (1978) considered *Phaseolus affinis* a synonym of *Macroptilium atropurpureum* (Sessé & Mociño ex DC.) Urban, Lackey (1983) informally recognized *Phaseolus affinis* as a species of *Macroptilium*, independent from the latter, while computing information for this taxon. Indeed, *Macroptilium ecuadoriense* is readily distinguished from *M. atropurpureum* by vegetative and reproductive characters, including pollen shape and sculpture listed in Table 1. Moreover, *Macroptilium ecuadoriense* is uniquely distinguished from all other *Macroptilium* species by its pubescent wing petals.

Distribution and habitat. *Macroptilium ecuadoriense* inhabits humid montane sites, though not necessarily at higher elevations and, according to Spruce's field notes, this plant was collected in sandy and stony soils. On the basis of the two specimens available for this study, *M. ecuadoriense* is confined to the inter-Andean valleys of the Ecuadorian Andes to the south of Quito. Such rarity and limited distribution may be one reason why this species was not incorporated in a recent catalog of Ecuadorian plants (Jørgensen & León-Yánez, 1999).

Specimen examined. ECUADOR. *Andium Aequator*, 6 June 1876, *André 3567* (NY).

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Typification of the Genus *Fordiophyton* (Melastomataceae) and Two New Combinations from China

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ABSTRACT. *Fordiophyton faberi* Stapf is selected as the type of *Fordiophyton* Stapf (Melastomataceae), which has not been typified before. Based on the characters of eight dimorphic and unequal stamens with the anther connectives not calcarate at the base, *Stapfiophyton* Li is recognized as a synonym of *Fordiophyton* Stapf. This results in two new combinations, *Fordiophyton degeneratum* (C. Chen) Y. F. Deng & T. L. Wu and *F. breviscapum* (C. Chen) Y. F. Deng & T. L. Wu.

Key words: China, *Fordiophyton*, Melastomataceae, *Stapfiophyton*.

Fordiophyton Stapf (Melastomataceae) comprises 11 species, including two new combinations proposed in the present paper, distributed in China and Vietnam. The genus is characterized by eight dimorphic and unequal stamens with the anther connectives not calcarate at the base (Li, 1944; How, 1958; Chen, 1984b; Renner, 1993; Hansen, 1992; Cellinese, 2002). *Fordiophyton* is affined to *Phyllagathis* Blume, but differs in its eight stamens (vs. 4 or 8, or rarely 10), unequal (vs. equal or subequal), and anther connectives not calcarate at the base (vs. usually short-calcarate). *Fordiophyton* is also close to *Sarcopyramis* Wallich in habit, which is acaulescent or subacaulescent, but differs in its striking stamen dimorphism and capsule morphology (Cellinese, 2002).

The name *Fordiophyton* was established in 1892 and contained two Chinese species, *F. cantonense* Stapf and *F. faberi* Stapf. Typification for the genus is necessary since the type of the genus was not originally designated by Stapf in 1892. Both species correspond to the original description of *Fordiophyton*. *Fordiophyton cantonense* was established by Stapf (1892) as a new combination based on *Sonerila fordii*, but the name is illegitimate according to Article 52.1 of the current ICBN (Greuter et al., 2000). Krasser (1893) correctly made a new combination, *Fordiophyton fordii* (Oliver) Krasser, for this species. Therefore, we select *F. faberi* Stapf as the lectotype for the genus.

Gymnagathis Stapf, typified by *G. peperomiaefolia* (Oliver) Stapf (basionym: *Sonerila peperomiaefolia* Oliver), based on collections from Kwangtung (Guangdong), China, was established by Stapf (1892) and accepted by Krasser (1893) and Diels (1932). Unfortunately, none of these authors noticed that *Gymnagathis* was an illegitimate generic name based on the prior homonym *Gymnagathis* Schauer (Linnaea 17: 243. 1843), which belongs to the Myrtaceae, now generally placed as a synonym of *Melaleuca* L. In 1944, Li proposed a new generic name, *Stapfiophyton*, to replace the illegitimate name *Gymnagathis* Stapf. Li (1944) stated that *Fordiophyton* is closely related to *Phyllagathis* in its herbaceous habit and stamen structure, but differs in the habit of acaulescent or subacaulescent herb, the cymose-subracemose inflorescence, and strongly dimorphic stamens in two series. He recognized three species including his two new combinations, *S. elattandrum* and *S. tetrandrum*, which were originally described in the genus *Phyllagathis* by Diels (1932) and then re-transferred into *Phyllagathis* by Chen (1984a) and Hansen (1992). *Stapfiophyton tetrandrum*, a subacaulescent herb, has umbellate inflorescences and is one of the few species with only four stamens. *Stapfiophyton elattandrum* has subequal stamens and is one of the few species with four fertile stamens and four staminodes. Placement of *S. elattandrum* and *S. tetrandrum* confused the boundaries of *Stapfiophyton*.

Hu (1952) described a fourth species, *Stapfiophyton erectum* S. Y. Hu, based on collections from Yunnan Province. She pointed out that it can be placed either in *Phyllagathis* or *Stapfiophyton* by its disintegrating fruit placenta, and she chose *Stapfiophyton* because of its cymose-paniculate inflorescences. This fourth species, with eight subequal stamens and anther connectives with short spurs, was transferred to *Phyllagathis* by Chen (1984a, 1984b).

Chen (1984a) argued that Li (1944) confused the concept of *Stapfiophyton* with *Phyllagathis* and redelimited the genus as characterized by the acaulescent or subacaulescent habit, the cymose-subracemose inflorescences, eight stamens in two

unequal series, the longest anther ca. 7 mm long, and its anther sacs not evident at the base. He recognized three species in *Stapfiophyton*, including his two new species, *S. breviscapum* C. Chen and *S. degeneratum* C. Chen, and excluded three other species included by Li (1944) and Hu (1952). Chen (1984b) recognized eight species in the genus in China divided into two sections according to their habit: section *Fordiophyton* is erect and section *Repentia* C. Chen is prostrate.

In his revision of *Phyllagathis* for Indo-China and China, Hansen (1992) argued that *Stapfiophyton* was heterogeneous, stating that the type species, *S. peperomiifolium*, is similar to *Fordiophyton* in having raphides and in the dimorphic and unequal anthers with small pores. *Stapfiophyton peperomiifolium* was transferred to *Fordiophyton* by Hansen (1992). Thus, *Stapfiophyton* becomes a synonym of *Fordiophyton*. As to the other species previously placed in *Stapfiophyton*, Hansen (1992) agreed with Chen (1984a) that *S. erectum* and *S. tetrandrum* belonged to *Phyllagathis*. Because no material was available, the placement of *S. breviscapum* and *S. degeneratum* could not be decided. *Stapfiophyton elattandrum* was transferred to *Phyllagathis*, but treated as uncertain (Hansen, 1992).

Prior to Hansen (1992), *Stapfiophyton* was recognized as a distinct genus by most authors (Li, 1944; Hu, 1952; How, 1958; Chen, 1979, 1984a, 1984b; Wu, 1991). It differs from *Fordiophyton* in its longest anther ca. 7 mm long (vs. longer than 12 mm) and its anther sacs evident at the base (vs. not evident) (Li, 1944; Chen, 1984b). However, these characters are not sufficient to separate *Stapfiophyton* from *Fordiophyton*. During editing of the family Melastomataceae for the *Flora of Guangdong*, we agreed with Hansen (1992) that *Stapfiophyton* should be reduced to *Fordiophyton* and *S. peperomiifolium* transferred to *Fordiophyton*. Given this reduction of *Stapfiophyton*, the placement of Chen's two species *S. breviscapum* and *S. degeneratum* must be evaluated. After checking their types, we affirmed that these two species have eight dimorphic and unequal stamens with the anther connectives not calcarate at the base and fit into the morphological boundaries of *Fordiophyton*. Therefore, two new combinations are required.

Including two new combinations proposed here, *Fordiophyton* consists of 11 species in China and Vietnam: *F. brevicaule* C. Chen, *F. breviscapum* (C. Chen) Y. F. Deng & T. L. Wu, *F. cordifolium* C. Y. Wu ex C. Chen, *F. degeneratum* (C. Chen) Y. F. Deng & T. L. Wu, *F. faberi* Stapf, *F. fordii* (Oliver) Krasser, *F. longipes* Y. C. Huang ex C. Chen, *F. multiflorum* C. Chen, *F. peperomiifolium* (Oliver) C. Hansen, *F. repens* Y. C. Huang ex C. Chen, and *F. strictum* Diels.

Fordiophyton Stapf, Ann. Bot. 6: 314. 1892. TYPE: *Fordiophyton faberi* Stapf (lectotype, designated here).

Stapfiophyton H. L. Li, J. Arnold Arbor. 25: 28. 1944. Replaced name: *Gymnagathis* Stapf, Ann. Bot. 6: 315. 1892, non *Gymnagathis* Schauer, 1843. TYPE: *Stapfiophyton peperomiaefolia* (Oliver) H. L. Li.

Eleven species distributed in southern China and northern Vietnam.

Fordiophyton breviscapum (C. Chen) Y. F. Deng & T. L. Wu, comb. nov. Basionym: *Stapfiophyton breviscapum* C. Chen, Bull. Bot. Res. 4: 57. 1984. TYPE: China. Guangdong: Liannan, Baimang, "prope rivulas in locis udis regionis convallae montanae, infra dense rarove silvis," 20 Aug. 1958, *Tan Peixiang (P. C. Tam) 59165* (holotype, IBSC).

Distribution. *Fordiophyton breviscapum* is endemic to China, known from Hunan and Guangdong. It occurs in wet sloping meadows by rivers, from 700 to 1150 m.

Fordiophyton breviscapum differs from *F. peperomiifolium* in its stem 10–20 cm (vs. shorter than 5 cm), 4-angular and 4-ribbed (vs. terete), leaves ovate to sublanceolate (vs. cordate), 5–8.5 cm (vs. 6–11 cm) long, 2–3.5 cm (vs. 3.5–7 cm) broad, base cuneate or obtuse (vs. cordate), apex acuminate (vs. acute), 3-nerved (vs. 7- to 9-nerved) (Chen, 1984a, 1984b).

Additional specimens examined. CHINA. **Hunan:** Yizhang xian, Mangshan, Pingkeng, Hongxingqiao, *Huang Maoxian 112320* (IBSC); Yizhang xian, Mashan, Huoshaoao, *Huang Maoxian 112352* (IBSC); Yizhang xian, Manshan, Laofengkeng, *Huang Maoxia 111918* (IBSC); Yizhang xian, Jinquan xiang, Mangshan, *Liang Baohan 83831* (IBSC). **Guangdong:** Liannan xian, Jinkeng xiang, Huangdong, W. Lingzui, *Tan Peixiang 59562* (IBSC); Ruyuan xian, Luoyang xiang, near Datianjinshan, *Huang Zhi 42909* (IBSC).

Fordiophyton degeneratum (C. Chen) Y. F. Deng & T. L. Wu, comb. nov. Basionym: *Stapfiophyton degeneratum* C. Chen, Bull. Bot. Res. 4: 58. 1984. TYPE: China. Guangxi: Fusui, Damingshan, "prope rivulas in convallis montibus saxorum calcareorum," 200–300 m, 2 May 1957, *Chen Shaoqing (S. H. Chun) 12160* (holotype, IBK; isotype, IBSC).

Distribution. This species is known from Guangdong Province and Guangxi Zhuangzu Autonomous Region, China, growing on limestone

cliffs or in wet places by rivers at elevations from 200 to 300 m.

Fordiophyton degeneratum is easily distinguished from other species in the genus by having four fertile stamens and four staminodes (Chen, 1984a, 1984b). Similar androecial characters also occur exceptionally in *Phyllagathis elattandra* Diels (Diels, 1932; Li, 1944; Chen, 1984a, 1984b) and *Kerriothyrsus* Hansen (1988). *Phyllagathis ellatandra,* considered an uncertain species in *Phyllagathis* by Hansen (1992), was included in *Stapfiophyton* (now *Fordiophyton*) by Li (1944) because of its anther connectives short-calcarate at the base. Laos monotypic *Kerriothyrsus* Hansen is characterized by having four fertile stamens and four staminodes and differs from *Fordiophyton* in its scorpioid inflorescence, olive-colored seed coat, and smooth testa. We place this species in *Fordiophyton* rather than *Phyllagathis* or *Kerriothyrsus* because its inflorescence is cymose-subracemose, the fertile stamens have anther connectives that are not calcarate, by the absence of stamen ventral appendages, and by a tuberculate seed testa.

Additional specimen examined. CHINA. **Guangdong:** Maoming xian, Pengqing xiang, Lingdengling, *Zhanjiang Plant Exped. 4071* (IBSC).

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A New Species of *Astragalus* (Fabaceae, Tribe Galegeae) from Iran

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ABSTRACT. A new *Astragalus* species (family Fabaceae) with a glabrous ovary and pod, loose inflorescence, and 3 to 5 leaflets is described and illustrated: *Astragalus joharchii*. It is endemic to the Khorassan province of eastern Iran. Morphological evidence (bifurcated trichome, long stem, connate stipules, few leaflets, short peduncle, campanulate calyx, non-inflated calyx in fruit) supports taxonomic placement in *Astragalus* sect. *Ammodendron*, and the species appears to be most closely related to *A. glabellus*, as they share a glabrous ovary, glabrous pod, number of leaflets, and peduncle length.

Key words: *Ammodendron*, *Astragalus joharchii*, Fabaceae, Iran.

Astragalus L. is a member of the legume family (Fabaceae) and is traditionally classified in the tribe Galegeae. This genus is the largest in Iran's flora, and its species are located throughout most areas of the country. Iran is considered a major center of diversity for *Astragalus*, having approximately 36% of the Old World species located within its boundaries (Maassoumi, 1998; Ghahreman et al., 2002). In this paper a new species within *Astragalus* sect. *Ammodendron* Bunge is described from Iran. This section was originally established in 1868 with 19 species, but now contains 61 species (based on Podlech & Zarre, 2003; Ghahremaninejad, 2004a, 2004b).

Astragalus sect. **Ammodendron** Bunge, Mém. Acad. Imp. Sci. Saint Pétersbourg 11, 16: 109, 1868. TYPE: *Astragalus ammodendron* Bunge (lectotype, designated by Podlech (1990: 464)).

The section belongs to *Astragalus* subg. *Cercidothrix* Bunge, which is characterized by perennial growth and the presence of bifurcate hairs (Bunge, 1868). A concise description of *A.* sect. *Ammodendron* Bunge follows:

Perennial, shrubs or semishrubs, vested with bifurcate hairs; stipules adnate to the petiole, connate; leaves imparipinnate; leaflets usually 1 to 3 pairs; bracteoles usually absent; inflorescence usually short-pedunculate; fruit calyx campanulate to cylindric-campanulate, non-inflated; corolla glabrous; pod stipitate or sessile, coriaceous, bilocular.

Astragalus joharchii F. Ghahremaninejad & J. F. Gaskin, sp. nov. TYPE: Iran. Khorassan Prov.: Torbat-e Jam, Pasgah-e Zakani, 680 m, 7 May 2002, *M. R. Joharchi 37246* (holotype, FAR; isotypes, FUMH, MO, MSB). Figures 1, 2.

Differt ab *A. glabello*: foliolis 6–25 × 4–9(10) (nec 4–14 × 2–4) mm; racemis 15–19 (nec 3–10)-floribus, 17–25 (nec 1–5) cm longis.

Perennial, at least 43 cm tall, vested with bifurcate hairs; stems 12–20 cm, hairs densely appressed white. *Stipules* 1–2.5 mm, adnate to the petiole, almost fully connate, membranous, white-hairy; *leaves* imparipinnate, both petiole and rachis densely canescent; petiole together with rachis 1.2–2.7 cm, persistent; leaves 3 to 5, leaflets oblong to oblong-elliptic, acute, 6–25 × 4–9(10) mm, moderately to densely appressed on the lower surface, almost glabrescent above; *inflorescence* 17–25 cm, loosely 15- to 19-flowered; *peduncles* 1–7 cm, covered densely with appressed white hairs; *bracts* triangular-lanceolate, 1–2 mm, sparsely covered with white hairs; *bracteoles* wanting; *pedicels* 1.5–2 mm, densely covered with white and black hairs. *Calyx* campanulate, 9–9.5 mm, not inflated in fruit, finally ruptured by the fruit, covered with appressed white, long (1–1.5 mm) asymmetrical hairs and few black hairs; calyx teeth 1.5–2 mm, ¼ as long as the tube; *corolla* drying yellow to violet, glabrous; standard 16–17 mm, the limb rounded-elliptic at the apex, scarcely retuse, 6 mm wide, without distinct claw; wing 14–15 mm long, the limb oblong to oblong-elliptic, 6–6.5 × 1.7–2 mm, the auricle 1 × 0.9 mm; keel 11.5–12 mm long, the limb 4–4.5 × 2–2.2 mm, the auricle 0.6 × 0.6 mm; *ovaries* stipitate, 4.5–5 mm, glabrous; style 8 mm, glabrous; *stamens* 13–13.2 mm, the free portion 4–4.5 mm; anther

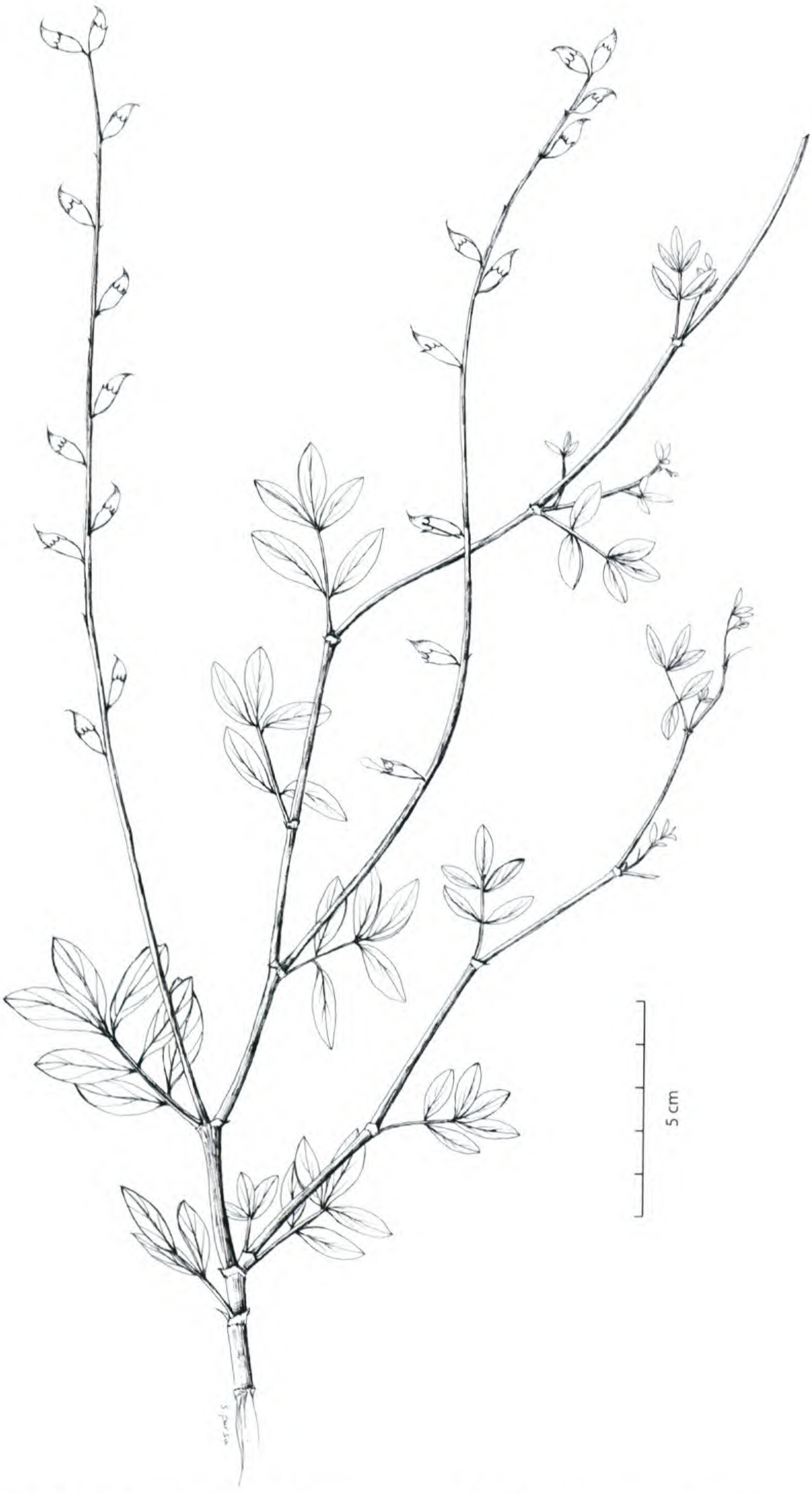

Figure 1. Holotype of *Astragalus joharchii* F. Ghahremaninejad & J. F. Gaskin (after *M. R. Joharchi 37246*, FAR).

0.4–0.5 × 0.25 mm. *Pods* sessile to shortly stipitate (with a stipe ca. 1 mm long), ellipsoid, acute, 11.5–12 × 3 mm in the middle part, terminating in a beak, glabrous, bilocular; *seeds* 2 in each pod, green, smooth, 3–3.2 × 2–2.1 mm.

Phenology. Flowering and fruiting April–May.

Etymology. The specific epithet is in honor of the collector of the specimen, M. R. Joharchi, an Iranian plant taxonomist.

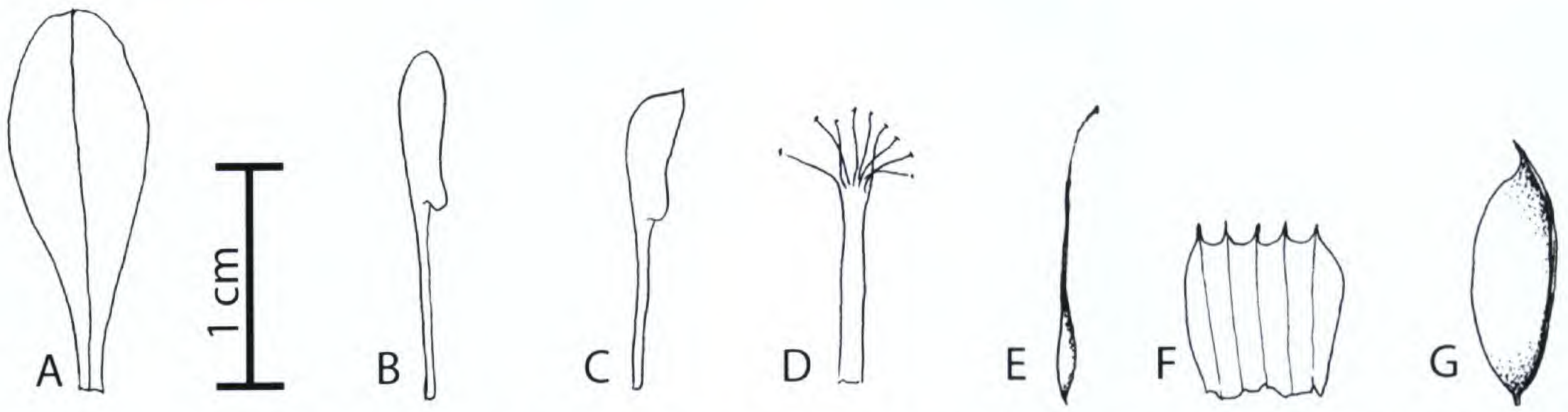

Figure 2. *Astragalus joharchii.* —A. Standard. —B. Wing. —C. Keel. —D. Stamens. —E. Pistil. —F. Calyx. —G. Fruit. After *M. R. Joharchi 37246* (FAR).

Phytogeographic and Taxonomic Remarks

This endemic species has been known only from the type locality. Recently the type specimen was collected in the Khorassan province near the Afghanistan border. However, the authors could not find another specimen of it in any Iranian herbaria. The new species *Astragalus joharchii* is well distinguished from the majority of Iranian species in section *Ammodendron* by the combination of a glabrous and sessile to shortly stipitate pod. Morphologically, the closest relative of this species (due to shared glabrous ovary, glabrous pod, number of leaflets, and peduncle length) is an endemic from Afghanistan: *A. glabellus* (Podlech, 1985). *Astragalus joharchii* differs from *A. glabellus* in having a longer inflorescence (17–25 vs. 1–5 cm), more flowers in each raceme (15 to 19 vs. 3 to 10 flowers), longer (6–25 vs. 4–14 mm) and wider (4–10 vs. 2–4 mm) leaflets, and longer floral parts (calyx 9–9.5 vs. 6 mm and standard 16–17 vs. 14 mm). The majority of the species in this section are desert plants distributed in Middle Asia, Iran (Table 1), and Afghanistan (based on Lock & Simpson, 1991; Yakovlev et al., 1996). In Iran, *Astragalus* sect. *Ammodendron* species are concentrated in xeric habitats of central, southern, and eastern parts of the country, and are distributed between 40 and 3400 m altitude (Ghahremaninejad, 2004a).

Table 1. List of Iranian species of *Astragalus* sect. *Ammondendron* (based on Lock & Simpson, 1991; Podlech & Zarre, 2003; Ghahremaninejad, 2004b). An asterisk indicates that the species is endemic to Iran.

1. *A. acutifolius* Bunge
2. *A. ahmed-adlii* Bornmüller & Gauba*
3. *A. ammodendroides* Bornmüller*
4. *A. bazarganii* Podlech & Zarre*
5. *A. baharensis* F. Ghahremaninejad*
6. *A. biarjmandicus* Podlech & Zarre*
7. *A. brevipetiolatus* Širjaev & Rechinger f.*
8. *A. darrehbidensis* Podlech & Zarre*
9. *A. erwinii-gaubae* Širjaev & Rechinger f.*
10. *A. joharchii* F. Ghahremaninejad & J. F. Gaskin*
11. *A. kavirensis* Freitag*
12. *A. macrobotrys* Bunge*
13. *A. nowroozii* Podlech & Zarre*
14. *A. oligophyllus* Boissier
15. *A. podolobus* Boissier
16. *A. squarosus* Bunge
17. *A. strictissimus* Podlech & Zarre*
18. *A. tarumensis* Širjaev & Rechinger f.*
19. *A. tenuiramosus* Podlech & Zarre*

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A New Species of *Gochnatia* (Asteraceae, Mutisieae) from the Desert Scrubland of the State of Hidalgo, Mexico

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ABSTRACT. A new species, *Gochnatia hiriartiana* Medrano, Villaseñor & Medina (Asteraceae, tribe Mutisieae), of the desert scrubland of the state of Hidalgo, Mexico, is described. Its distinctive morphological traits are discussed and compared with the other Mexican species of *Gochnatia*. A key to the Mexican species of the genus is provided.

Key words: Asteraceae, *Gochnatia*, Mexico, Mutisieae.

Gochnatia Kunth (Asteraceae, Mutisieae) is a genus of more than 60 species (Cabrera, 1971; Bremer, 1994; Freire et al., 2002) distributed disjunctly in Asia, the Caribbean Region, South America, and North America. The genus is characterized by its actinomorphic, deeply 5-lobed cream or pale yellow corollas; anthers with caudate basal appendages and acute or apiculate apical appendages; short and glabrate (smooth) style branches; achenes pubescent; and a pappus of numerous bristles.

Routine identification of specimens and field exploration in order to document the richness and distribution of Mexican Asteraceae has resulted in the discovery of the following new species.

Gochnatia hiriartiana Medrano, Villaseñor & Medina, sp. nov. TYPE: Mexico. Hidalgo: Municipio Meztitlán, 3 km al E de Milpa Grande, barranca sobre el río Amajac, 19 Sep. 1996, *F. González-Medrano, G. G. Hernández & G. Rodríguez 17920* (holotype, MEXU; isotypes, IEB, MO, TEX, XAL). Figure 1.

Differt a ceteris speciebus mexicanis capitulis solitariis vel 2–3, grandissimis et floribus numerosissimis.

Shrubs 1.0–1.5 m tall, stems densely and finely puberulent, upper branches densely leafy distally, trichomes yellowish, grayish when older. Leaves simple, alternate, coriaceous, ascending, sessile or very short-petiolate, conspicuously discolorous, venation acrodromous suprabasal imperfect, constituted by three main veins borne above the leaf base, conspicuous on both surfaces; petiole when present 1.0–2.0(–3.0) mm long; blades ovate or ovate-lanceolate, (1.0–)2.0–3.5 cm long, 1.0–1.7 (–2.0) cm wide, base rounded or shortly attenuate, apex acute or acuminate, margins entire, revolute, adaxial surface shiny green, glabrous, slightly rugous at touch, abaxial surface yellowish, finely and densely puberulous. Capitula homogamous, solitary at the end of branches or in clusters of 2 to 3, sessile, 3.0–4.5 cm wide including florets, not held above subtending leaves; receptacle naked, slightly alveolate. Involucre turbinate-obconic, 1.5–2.0 cm tall, 2.5–3.5(–4.0) cm wide; phyllaries 1.2–1.4 cm long, firm, in (4)5 to 6 spirally arranged series, conspicuously imbricated, narrowly to broadly lanceolate, acute at apex, pale yellow or pale gray when old, densely puberulous abaxially, glabrous adaxially. Florets 200 to 230 per capitulum, actinomorphic, perfect and fertile, corollas pale yellow or white, glabrous, 5-lobed, 13–22 mm long, the tube 9–12 mm long, the throat 1.5–2.0 mm long, the lobes linear, 6–8 mm long, reflexed in the peripheral florets and conspicuously recurved in the central ones; stamens 5, anthers 0.7–1.0 cm long, base caudate, basal appendages 2.0–2.5 mm long, apical appendage ca. 1.5 mm long, acute or acuminate, slightly incurved, filaments 3.0–4.0 mm long; style 1.8–2.2 cm long, the branches 2.0–3.0 mm long, rounded at apex, without collecting trichomes. Achenes 3.0–4.5 mm long, narrowly obpyramidal, inconspicuously 3- or 4-angled, sericeous, yellow to pale brown with age; pappus of numerous bristles, white or pale yellow, about 1.0 cm long, several of them sometimes shorter, slighty broadened at the apex.

Gochnatia hiriartiana is known only from two collections, in vegetation of desert scrubland in the state of Hidalgo, Mexico, at about 1700 m elevation, on northeastern slopes with *Acacia berlandieri* Bentham (Mimosaceae), *Agave xylonacantha* Salm-Dyck (Agavaceae), *Ageratina espinosarum* (A. Gray) R. M. King & H. Robinson (Asteraceae), *Gymnosperma glutinosum* (Sprengel) Lessing (Asteraceae),

Figure 1. *Gochnatia hiriartiana* Medrano, Villaseñor & Medina. —a. Branches with capitula. —b. Capitulum. —c. Central floret. —d. Style branches. —e. Apical portion of the pappus bristles. —f. Peripheral floret with the lobes recurved. —g, h, i. Details of the anthers showing the caudate bases (i) and the apical appendage (h). Drawn from the holotype at MEXU (*González-Medrano et al. 17920*).

Helietta parvifolia (A. Gray ex Hemsley) Bentham (Rutaceae), *Leucophyllum ambiguum* Bonpland (Scrophulariaceae), *Machaonia coulteri* (Hooker f.) Standley (Rubiaceae), and *Turnera diffusa* Willdenow ex Schultes (Turneraceae).

The new species is outstanding among the other Mexican species of the genus because of its larger capitula (involucre 2 cm or more wide), solitary or in a cluster of 2 or 3 by branch, sessile and covered at the base by the leaves. All the other known Mexican species have smaller capitula (involucre 1.5 cm or less wide), generally arranged in glomerules or congested cymes. Another feature of this new species is the number of florets per capitulum (200 or more); no other Mexican species has capitula with this many florets, generally counting 60 or less.

By its number of florets and the arrangement of the heads, *Gochnatia hiriartiana* belongs to *Gochnatia* sect. *Glomerata* S. E. Freire, L. Katinas & G. Sancho (Freire et al., 2002). Among the features that characterize the members of this section are their heads solitary or 2 to 3 by branch, the number of phyllary series (mostly 5 or 6), and the pappus with several short outer bristles. It differs from the other species of the section (all Mexican) by its large number of florets per capitulum: this new species has more than 200 florets, while the other species rarely reach 60 per capitulum.

Etymology. The epithet honors Patricia Hiriart-Valencia (1947–1991), botanist and student of the flora of the dry regions, especially from central Mexico where this new species was found.

Paratype. MEXICO. **Hidalgo:** Arriba de Chalmita, 2 Nov. 1946, *F. Miranda 4027* (MEXU).

Key to the Mexican Species of *Gochnatia*

1a. Florets 200 or more per capitulum; involucre 2 cm or more wide; state of Hidalgo . . *G. hiriartiana* Medrano, Villaseñor & Medina
1b. Florets 60 or fewer per capitulum; involucre 1.5 cm or less wide.
2a. Florets 10 or more per capitulum; involucre 5 mm or more wide.
3a. Leaf blade 3.0 cm or less long; state of Puebla . . . . . *G. purpusii* Brandegee
3b. Leaf blade 3.5 cm or more long.
4a. Florets 25 or less per capitulum; state of Baja California Sur . . . . . *G. arborescens* Brandegee
4b. Florets 35 to 60 per capitulum; states of Guanajuato, Hidalgo, Querétaro, San Luis Potosí, Tamaulipas . . . . . *G. magna* M. C. Johnston
2b. Florets 8 or fewer per capitulum; involucre 4 mm or less wide.
5a. Capitula in terminal rounded glomerules; leaves gray pubescent abaxially; state of Oaxaca . . . . . *G. smithii* B. L. Robinson & Greenman
5b. Capitula not in rounded glomerules, mostly in axillary or terminal glomerate cymes; leaves mostly yellow-pubescent abaxially.
6a. Leaf blade 2.0–5.0 cm long, generally lanceolate or elliptic-lanceolate; involucre 5–6(–7) mm long; Chihuahuan Desert, from Texas to the states of Hidalgo and Querétaro . . . . . *G. hypoleuca* (DC.) A. Gray subsp. *hypoleuca*
6b. Leaf blade 0.4–2.0 cm long, ovate or elliptic ovate; involucre 6–8 mm long; states of Oaxaca, Puebla, Veracruz . . . *G. hypoleuca* (DC.) A. Gray subsp. *obtusata* (S. F. Blake) Cabrera

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Salvia fairuziana (Lamiaceae), a New Species from Lebanon

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ABSTRACT. A new species of the genus *Salvia* L. (Lamiaceae) is described from the western slopes of Mount Lebanon characterized by a Mediterranean climate. *Salvia fairuziana* R. M. Haber & Semaan is distinguished by the following characters: perennial herb; hispid with dense tuberculate multiseptate trichomes emerging from wart-like turgid purple epidermal cells; leaves ovate-elliptic, cordate, shallowly lobed, verrucose; floral bracts discoidal, green with a white center and purple tips; verticillasters crowded; calyx 1.0–1.2 cm long, green, infundibular; corolla 2.4–2.7 cm long, lilac, squamulate, ventricose; staminal connectives dolabriform.

Key words: biodiversity, endemic, flora, Lamiaceae, Lebanon, Mediterranean.

According to Mouterde (1983), Lebanon possesses 18 species within the genus *Salvia* (Lamiaceae). Most of these have a wide distribution range in the Mediterranean region or occur eastward into Iran and Iraq (Hedge, 1982). Four species, however, are restricted to the eastern Mediterranean (Post, 1932; Mouterde, 1983). *Salvia rubifolia* Boissier, *S. viscosa* von Jacquin, and *S. pinardii* Boissier are limited to Lebanon and Syria; *S. judaica* Boissier occurs in Lebanon, Syria, and Palestine. *Salvia hierosolymitana* Boissier has a similar distribution to the latter, but also occurs in Jordan (Al-Eisawi, 1998) and northern Cyprus (Greuter & Raus, 1984).

Salvia fairuziana R. M. Haber & Semaan, sp. nov. TYPE. Lebanon. Kesrouan Province: Kfour village, 770 m, 34°02′09.6″N, 35°41′10.1″E, 17 May 2002, *R. Haber & M. Semaan 2002* (holotype, MO; isotypes, BEI, K). Figure 1.

Herba perennis; indumentum densum hispidum, unusquisque trichoma tuberculata multiseptata in tumulo ex epidermide turgido purpurato; folia verrucosa, ovato-elliptica, basi cordata, lobis lateralibus non profundis; bracteae florales virides, centris albidis; verticillastri congesti; calyces 1.0–1.2 cm longi, infundibulares, lobis non effusis in fructibus; corollae 2.4–2.7 cm longae cum squamulis, ventricosae, labiis lilacinis; connectiva dolabriformia.

Perennial herb 50–80 cm high, with a distinctive and pleasant fragrance, mostly single-stemmed; stem 0.6–0.7 cm wide at base, simple, hispid with dense tuberculate and multiseptate trichomes, each emerging from a wart-like mound of turgid, purple epidermal cells, and also pilose with trichomes mostly arising from purple bases on the lower stem to short glandular on the upper. *Basal leaves* 15.0–18.5 × 6.5–8.0 cm, petiolate; petiole 5.5–6.5 cm long, pilose, with tuberculate multiseptate trichomes arising from purple mounds, with the indument extending to the midrib below; *blade* ovate, obtuse, cordate, shallowly lobed, erose, much verrucose above with multiseptate, tuberculate lanate-arachnoid trichomes mainly at the tips of verrucae, reticulate below with multiseptate, variably tuberculate lanate-arachnoid trichomes; *cauline and floral leaves* 3.0–12.5 × 2.3–6.0 cm, with indumentum similar to the basal leaves; the lower leaves shortly petiolate to sessile, ovate-elliptic, obtuse, cordate, unequal at base, shallowly lobed, sinuate, erose; *upper leaves* amplexicaul, ovate-lanceolate, acute-acuminate, cordate, unlobed, very sinuate, slightly undulate, erose; *floral bracts* 1.0–2.6 × 0.5–2.3 cm, the lower orbicular-reniform, acuminate, cordate, sinuate, erose, glabrous above, smooth at center, lanate-arachnoid and verrucose at the periphery, lanate below with tuberculate multiseptate trichomes, the upper bracts ovate, acuminate, entire, ciliate, glabrous to pubescent with tuberculate short, stout septate trichomes, discoidal with a white center and a green margin sometimes tinted purple especially at the tips of the flowering branches, the margin with some glandular trichomes above, but with arachnoid and short tuberculate trichomes below. Panicle commencing from the second or third stem node, 15–30 cm long,

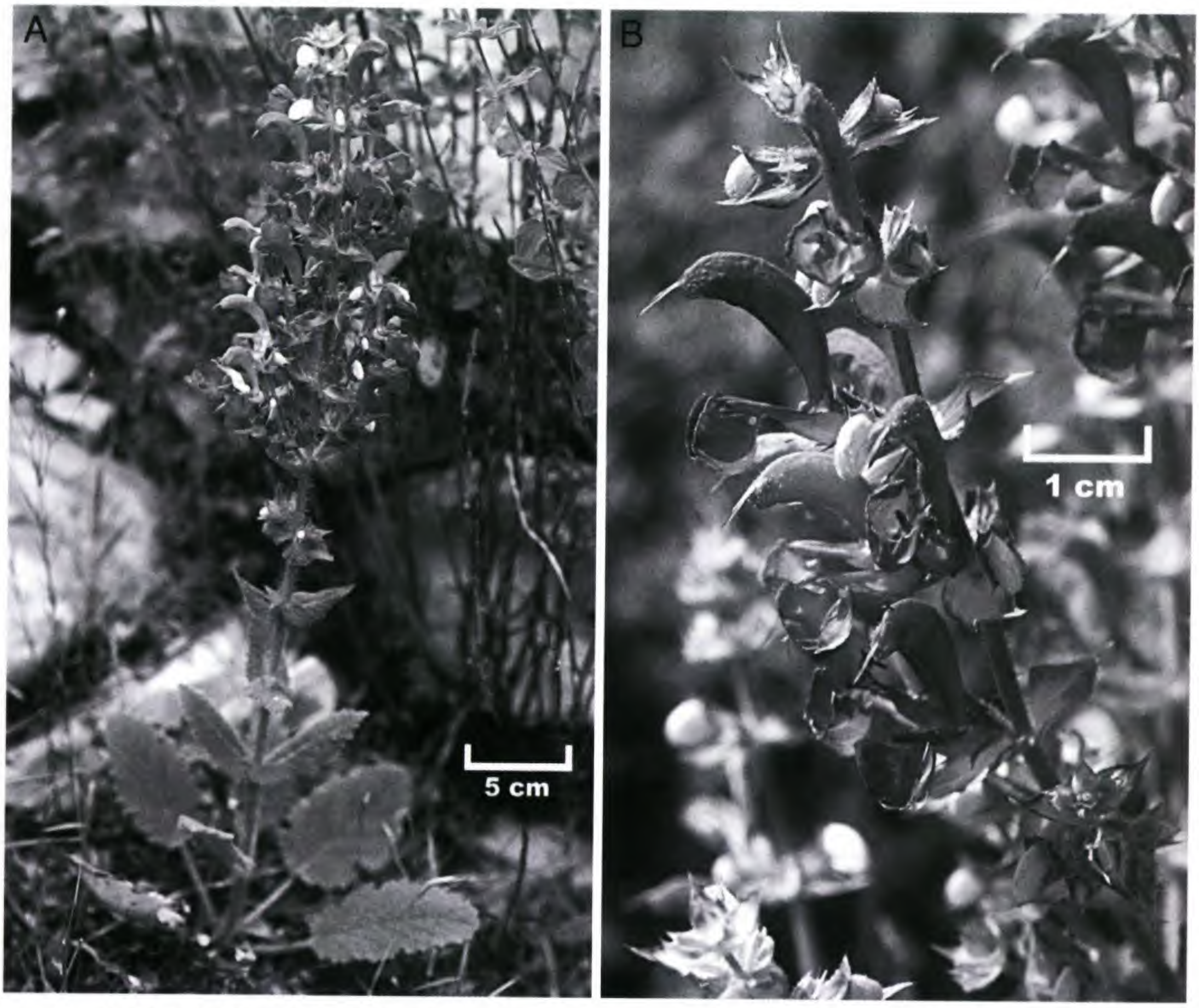

Figure 1. *Salvia fairuziana* R. M. Haber & Semaan, photos from the typified collection taken by the authors in Kfour village. —A (left). Whole Plant. —B (right). Verticillasters.

erect, densely covered with purple-based tuberculate multiseptate and short glandular trichomes; panicle branches up to 15, each 7–10 cm long with 5 to 7 verticillasters, sometimes with secondary branches, the lowermost usually aborted; *verticillasters* crowded, each 2- to 6-flowered, with flowers longer than the internodes. *Flowers* 2.6–2.8 cm long; pedicels 3 mm long with dense glandular trichomes and short stout tuberculate-septate eglandular trichomes; *calyx* 1.0–1.2 cm long, infundibular, 13-veined, green, with a purple tint that increases gradually in density from the lower part to the upper part of the panicle; tube 6 mm long, with dense glandular trichomes and short rigid tuberculate-septate eglandular trichomes especially on veins, pilose inside; *lower lip* with two teeth 5–6 mm long, triangular-subulate, with mucro 1.5 mm long; *upper lip* 5.5 × 3.0 mm, truncate, tridentate with the middle tooth shorter, flat, concave; teeth mucronate, ciliate with short rigid tuberculate-septate trichomes; *corolla* 2.4–2.7 cm long, white to faintly lilac in bud, lilac-violet in flower; tube 8 mm long, white, ventricose, squamulate, with an internal fimbriated scale on squamula; *lower lip* 8–10 mm long, with short trichomes and sessile glands; *upper lip* 17–19 mm long, very falcate, emarginate, with short tuberculate-septate eglandular trichomes, glandular trichomes, and sessile glands; *pistil* 36 mm long, exserted by 5–7 mm, lilac to violet at the tip; *stigma* bifid, unequal; *staminal connectives* clearly longer than, and articulating with, the filaments, *anthers and connectives* 22 mm long; lower theca 2.9 mm long, sterile, reduced to a dolabriform plate, with a tooth running down the plate. *Seed* 2.2–2.3 × 1.7–1.8 mm, brown, finely tuberculate, with darker venation, ovoid, rounded on the outside, angled on the inside and with a rounded apex.

Distribution and habitat. *Salvia fairuziana* is local and relatively rare. The authors observed a population comprising a few hundred specimens extending between 700 and 900 m altitude near Kfour village. There it grows among calcareous

rocks in Mediterranean red soil in an open *Quercus coccifera* L. grove (De Vaumas, 1954).

Derelict terraces where *Salvia fairuziana* grows indicate that the region was previously managed for agriculture. This may have allowed the plant to survive unnoticed and to regain a foothold as the terraces were abandoned several decades ago. However, urban sprawl and encroaching development on the mountainside have destroyed large expanses of the original habitat and remain a serious threat to the extant population. The flowering period of *Salvia fairuziana* has been observed by the authors to extend from May to June.

Salvia fairuziana most closely resembles *S. sclarea* L., *S. indica* L., *S. chrysophylla* Stapf, and *S. argentea* L. based on its dolabriform articulate stamens, squamulate and ventricose corolla tube, and its lilac-colored corolla upper lip. However, *S. fairuziana* differs from *S. sclarea* in having green, not pink-mauve, bracts. While the hood and lower lip of the corolla are similarly colored lilac in *S. fairuziana*, the lower lip is variably colored in *S. indica*, *S. chrysophylla*, and *S. argentea*, being dark violet, yellow, and white, respectively. In addition, the latter three have lax verticillasters, whereas those of *S. fairuziana* are congested.

Salvia fairuziana also differs markedly from other eastern Mediterranean *Salvia* species existing in Lebanon. *Salvia rubifolia* and *S. pinardii* occur in the continental semi-arid habitat while *S. viscosa*, *S. hierosolymitana*, and *S. judaica* may occur in habitats and climatic conditions similar to those of *S. fairuziana*. *Salvia hierosolymitana* has a red corolla and calyx, *S. judaica* a violet corolla (10 mm long) and red calyx, and *S. viscosa* a pink to pale violet corolla (15 mm long). In contrast, *S. fairuziana* has a green calyx and lilac corolla (24–27 mm long).

Salvia fairuziana is named, on behalf of the millions of admirers, as homage, gratitude, and respect to the Lebanese operatic diva, Lady Fairuz, who has, for the past 50 years, enchanted the country, inspiring humaneness, patriotism, and respect for nature.

Paratype. LEBANON. **Kesrouan Province:** Kfour village, 755 m, 34°01′48.3″N, 35°40′39.2″E, 8 June 2002, *R. Haber & M. Semaan 2002* (MO).

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A New Species of *Phegopteris* (Thelypteridaceae) from Korea

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ABSTRACT. A new species of fern, *Phegopteris koreana* (Thelypteridaceae), was collected from southern Korea and is described here. *Phegopteris koreana* is most similar to *P. decursive-pinnata* morphologically; however, the new species consistently shows discontinuous morphological gaps from the latter in the shape of the fronds, pinnae, and ultimate segments, venation pattern in ultimate segments, tufted trichomes in the sori, and spore wall sculpturing.

Key words: Korea, *Phegopteris*, Thelypteridaceae.

Thelypteridaceae Ching ex Pichi Sermolli are one of the largest families of ferns, comprising ca. 900 species mostly distributed in tropical regions (Grimes & Parris, 1986). The family is highly problematic, and there has been much confusion in the taxonomy of the family (Iwatsuki, 1965; Smith, 1990). The circumscription of genera varies greatly according to different authors, ranging from the recognition of only one genus, *Thelypteris* Schmidel, in the broadest sense to segregating ca. 30 genera by Holttum (1969, 1971, 1982). Most authors, however, agree that *Phegopteris* (C. Presl) Fée is one of the most distinctive elements in the family by the presence of wings on the rachis and recognize it as a distinct genus (Grimes & Parris, 1986; Smith, 1990, 1993; Shing et al., 1999).

Phegopteris is a small genus of only five species (including the new one described here) in temperate regions of the Northern Hemisphere in eastern Asia and North America. It is well distinguished from other genera of Thelypteridaceae by wings on the rachis, the wings uniting adjacent pinnae, the costae lacking an adaxial groove, the naked sori, and fronds lacking septate trichomes (Grimes & Parris, 1986; Smith, 1990, 1993; Shing et al., 1999). Among the species, *P. connectilis* (Michaux) Watt usually occurs in cool to cold climate regions and on mountains or in alpine regions in China, Japan, Korea, Russia (Siberia), Taiwan, North America, and northern Europe, whereas *P. decursive-pinnata* (H. C. Hall) Fée occurs mainly at low elevations in eastern Asia, including China, India, Indonesia, Japan, Korea, Indochina, and Taiwan. In contrast to the wide distribution ranges of those two species, *P. hexagonoptera* (Michaux) Fée is confined to southeastern North America, and *P. tibetica* Ching is restricted to high elevations in Xizang, China (Iwatsuki, 1965; Park, 1975; Smith, 1993; Shing et al., 1999).

During compilation of the fern flora of Korea, we found ferns that clearly belong to *Phegopteris*, but which cannot be placed within any of the known species. It is here described.

Phegopteris koreana B.-Y. Sun & C. H. Kim, sp. nov. TYPE: Korea. Jeollanam-do Province: Mt. Baekyang, under the edge of deciduous forest, partially shaded, 13 Oct. 2001, *Sun B.-Y. & C. H. Kim 434* (holotype, JNU; isotypes, JNU). Figure 1.

Korean name: Keun-seol-seol-go-sa-ri.

Haec species quoad rhizoma breve erectum vel adscendens etiam frondes caespitosas lamina ambitu lanceolata latitudinem maximam ad medium attingente ad *P. decursive-pinnata* maxime accedit, sed ab ea frondis lamina uni- vel bipinnata pinnis profunde pinnatisectis vel pinnatis, pinnulis vel segmentis crenato-lobatis latitudenem maximam ad medium attingentibus, pinnularum (vel segmentorum) venulis 1- ad 3-furcatis, capsula sporangiali setis usque ad 0.5 mm longis ornata atque sporis tuberculatis distinguitur.

Plants terrestrial, green in summer; rhizomes short, erect or ascending. Fronds monomorphic, clustered, 50–80 cm long; stipes 10–20 cm long, densely scaly at base, sparsely scaly elsewhere; scales 4–8 × 0.4–0.6 mm, linear-lanceolate, membranaceous, dark brown, margins setiferous; blades herbaceous, elliptic, broadest at middle portion, gradually narrowed toward caudate apex and blade

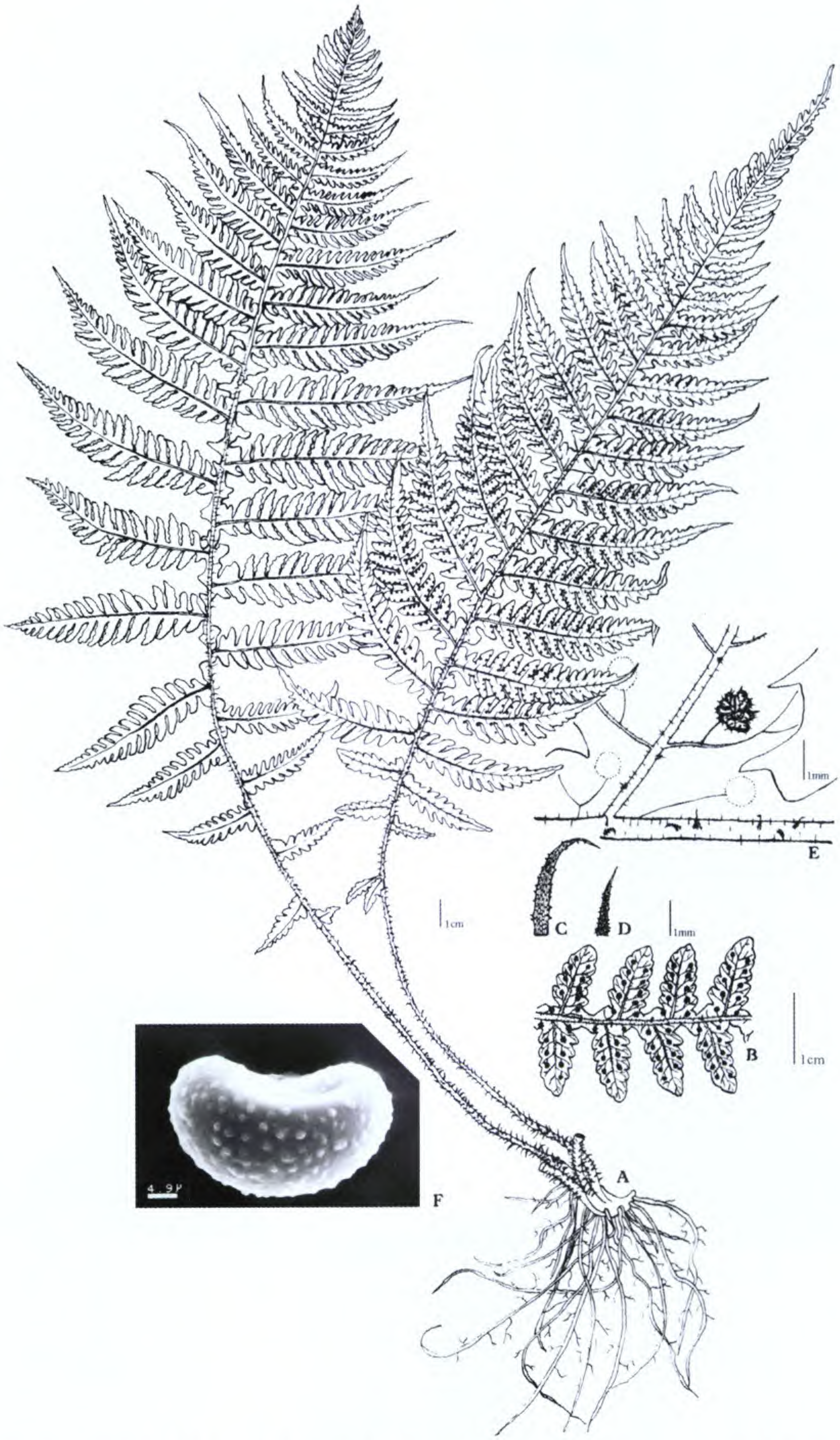

Figure 1. *Phegopteris koreana* B.-Y. Sun & C. H. Kim. —A. Habit. —B. Pinnae-pinnules or lobes with veinlets and sori. —C. Scale from stipe base. —D. Scale from rachis. —E. Sorus with hairs. —F. SEM microphotograph of spore. All are drawn from holotype, *Sun, B.-Y. & C. H. Kim 434* (JNU).

base, 40–60 cm long, 20–30 cm wide at middle, 1-pinnate with deeply pinnatisect pinnae or 2-pinnate; rachises winged by continuation of dilated (auricled) bases of pinnae, glabrous or sparsely pubescent, sparsely scaly; pinnae 5–13 × 1.5–2.5 cm at middle, gradually reduced in size toward base and apex, ca. 20 pairs, alternate, broadest at middle, narrowly elliptic, deeply pinnatisect or pinnate,

connected to adjacent pinnae by rachis wing except near basal ones, apex acuminate or caudate, sparsely pubescent and scaly; pinnules or pinnatisect segments in 15 to 20 pairs, nearly opposite, acute or obtuse, lobed-crenate; veins free, not reaching margins, generally forked 2 or 3 times on pinnules or pinnatisect segments. Sori round, nearly medial in 1 row, generally subterminal on the veins, with trichome tufts on the receptacles, which are less than 0.5 mm long; sporangial capsules sparsely setiferous, to 0.5 mm long, with sparse, stalked glandular trichomes; indusia lacking. Spores monolete, bilateral, tuberculate. Chromosome number $2n = 120$.

The principal attributes distinguishing *Phegopteris koreana* from *P. decursive-pinnata* are in characteristics of the fronds and in such micromorphological characters as the length of trichome tufts on the sori and in the spore wall sculpturing. *Phegopteris koreana* usually has fronds 50–80 cm long and 20–30 cm wide at the middle, while *P. decursive-pinnata* usually has smaller fronds, 20–60 cm long and 5–15 cm wide. Although both species have once-pinnate blades, the pinnae are basically different. The pinnae of *P. koreana* are deeply pinnatisect, and hence the fronds are bipinnatisect, or appear to be twice-pinnate. In contrast, the pinnae of *P. decursive-pinnata* are pinnatifid in the middle (and hence the fronds are bipinnatifid), and shallowly pinnatifid to lobed or crenate toward the base and apex. The shape of pinnae also differs. In *P. koreana*, the middle part is the broadest and hence the pinnae are narrowly elliptic. In *P. decursive-pinnata*, the margins are parallel and hence the pinnae are oblong except for the caudate apex. Each pinnule or pinnatisect segment (i.e., ultimate segment) of *P. koreana* is crenate, whereas the ultimate segments of *P. decursive-pinnata* are usually entire to subentire. The two species have trichome tufts on the receptacle of the sori, which are shorter, less than 0.5 mm long in *P. koreana*, and more than 0.5 mm long in *P. decursive-pinnata*. The venation pattern in ultimate segments also readily distinguishes the two species. In *P. koreana*, each pinnule or pinnatisect segment has veins that fork 2 or 3 times; in *P. decursive-pinnata* the ultimate segments have veins that are usually simple or rarely fork twice.

The spore wall sculpturing is different in the two species: the tubercles are well developed and relatively large in *P. koreana* (Fig. 1F), whereas the tubercles are nearly lacking or rarely are small and poorly developed in *P. decursive-pinnata*, as described by Tryon and Lugardon (1991).

Iwatsuki (1965) commented that *P. decursive-pinnata* is variable in the size and form of the fronds and cited a herbarium specimen (*Chou 382*) collected in Korea that showed bipinnatisect fronds more than 65 cm long. He treated this as a form of *P. decursive-pinnata*. However, in our comparative study of herbarium specimens collected from China, Japan, and Korea, this large, bipinnatisect or twice-pinnate form consistently differs from *P. decursive-pinnata* in the shape of the fronds, pinnae, and ultimate segments, tufted trichomes in the sori, and spore wall sculpturing. We therefore treat this specimen and similar plants as comprising a new species.

Paratypes. KOREA. **Jeollabuk-do:** Sunchang-gun, Mt. Hoemun, 1 Oct. 1997, *Hwang, Y. M. & Y. J. Ko s.n.* (JNU), *Rhyu, H. J. & B. R. Kang s.n.* (JNU); Temple Bogwangsa, 2 Sep. 1973, *T. B. Lee s.n.* (SNUA [4]); Mt. Naejang, 7 Aug. 1974, *T. B. Lee s.n.* (SNUA [2]). **Jeollanam-do:** Mt. Suin, near Castle Suin, 16 May 2003, *Sun, B. Y. s.n.* (JNU); Gwangyang-gun, Jinsang-myeon, Eochi-ri, 27 Aug. 2001, *Park, S. H. et al. s.n.* (JNU).

KEY TO THE SPECIES OF *PHEGOPTERIS* IN THE WORLD

1a. Rhizomes long creeping; fronds distantly spaced; blades deltate or nearly so, broadest at or near base.
  2a. Basal pair of pinnae connected to those next above by wing along rachis . . *P. hexagonoptera*
  2b. Basal pair of pinnae not connected to those next above by wing along rachis.
    3a. Blades 8–23 × 6–20 cm, deltate; basal pair of pinnae slightly longer than broad . . . . . *P. connectilis*
    3b. Blades 18–20 × 10–14 cm, narrowly deltate; basal pair of pinnae 2 times longer than broad . . . . . *P. tibetica*
1b. Rhizomes short, erect or ascending; fronds clustered; blades lanceolate, broadest at middle.
  4a. Blades 1-pinnate, pinnae lobed or pinnatifid, nearly parallel from base to middle, pinnules nearly entire; veinlets of pinnules simple, 1- or rarely 2-forked; setae on sporangial capsules 0.5–0.8 mm long; spore walls smooth, rarely with a few tubercles . . . . . *P. decursive-pinnata*
  4b. Blades 1-pinnate; pinnae deeply pinnatisect or blades 2-pinnate, broadest at middle, pinnules lobed-crenate; veinlets of pinnules 1- to 3-forked; setae on sporangial capsules to 0.5 mm long; spore walls tuberculate . . . . . *P. koreana*

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Six New Taxa of *Passiflora* (Passifloraceae), with Nomenclatural Notes on the Genus in Mesoamerica

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ABSTRACT. Nomenclatural notes, lectotypifications, a neotypification, and changes in synonymy affecting *Passiflora* (Passifloraceae) in Mesoamerica are presented, as well as descriptions of new varieties and species. Included are six new taxa: *P. cissampeloides*, *P. ornithoura* var. *chiapasensis*, *P. quetzal*, *P. quinquangularis*, *P. subfertilis*, and *P. veraguasensis*. Two taxa change rank: *P. sublanceolata* is elevated from *P. palmeri* var. *sublanceolata* Killip and *P. jorullensis* var. *salvadorensis* is lowered from *P. salvadorensis* J. D. Smith. The new combination *P. platyloba* var. *pubescens* (Grisebach) J. MacDougal must be substituted for *P. platyloba* var. *williamsii* (Killip) A. Gentry, and *P. serrulata* var. *pubescens* Grisebach is a synonym of *P. williamsii* Killip, not *P. vitifolia* HBK. The well-known name *P. pulchella* HBK is a new synonym of *P. bicornis* Miller; *P. brevipes* Killip is a new synonym of *P. cobanensis* Killip; *P. guatemalensis* S. Watson is not a synonym of *P. hahnii* (Fournier) Masters; *P. cookii* Killip is a new synonym of *P. hahnii*; and *P. obscura* Lindley is a new synonym of *P. sexflora* Jussieu. Lectotypes are designated for *P. divaricata* Grisebach (*Duchassaing s.n.*, anno 1850, GOET), *P. serrulata* β. *pubescens* Grisebach (*Duchassaing, s.n.* [1850–1851], GOET). The colored plate opposite page 430 in *Revue Horticole* 40 (1869) is designated as the neotype of *P. hahnii*.

Key words: Mesoamerica, *Passiflora*, Passifloraceae, S. Calderón.

Approximately 20% of the genus *Passiflora* L. grows in Mesoamerica, that area from southeastern Mexico through Panama. These 106 species are predominately members of the small-flowered and small-fruited passionflowers, subgenus *Decaloba* (DC.) Reichenbach. The last monograph of *Passiflora* (Killip, 1938) recognized about 70 species of the genus in Mesoamerica, and I and others have added numerous others in the last 20 years (e.g., Knapp & Mallet, 1984; MacDougal & Hansen, 2003). The genus has traditionally been divided into at least 22 subgenera (Killip, 1938). Here I use the recently published infrageneric classification by Feuillet and MacDougal (2003) that recognizes only four subgenera. The following new taxa and nomenclatural notes are the result of the preparation of a treatment of the Passifloraceae, still in press, for the *Flora Mesoamericana* project, and are published here in advance in order to make the new and correct names generally available. In the treatment of notes and novae below, accepted names are listed alphabetically.

Passiflora bicornis Houston ex Miller, Gard. Dict. ed. 8, Passiflora no. 13, 1768 [as "*Bicorna*"]. TYPE: Colombia. [Bolívar: near Cartagena], *Houston s.n.* (holotype, BM, photo at BH, NY, US).

Passiflora pulchella HBK, Nov. Gen. Sp. 2: 134. 1817. Syn. nov. TYPE: Venezuela. Aragua: Cura, "prope Cura (Valles de Aragua & Orinoco)," *Humboldt & Bonpland 1134* (lectotype, selected by Killip (1938: 226), B destroyed, photo at F neg. 16554, MO; isotype, B-W not seen, P).

Passiflora divaricata Grisebach, Bonplandia 6(1): 7. 1858. TYPE: Panama. Anno 1850, *Duchassaing s.n.* (lectotype, designated here, GOET).

Miller's older name supplants the widely known *Passiflora pulchella* of floras from Mexico to Venezuela. Killip (1938: 226) suspected this: "This may well be . . . *Passiflora bicornis* . . . but Miller's description is indefinite . . . in the absence of a type specimen, it seems best to maintain the name that is in general use." Examination of the type found at BM, with its well-preserved flower, large bracts, and bilobed leaves, now shows *Passiflora bicornis* to be an older name for the same species.

Killip (1938) also suggested that the type of the synonym *Passiflora divaricata* was a Duchassaing specimen at P, but in Grisebach's herbarium at GOET there are three elements from Duchassaing that appear to have been part of Grisebach's protologue. One is a watercolor painting with violet flowers, one has a divaricate branch described in the protologue, and one is marked in Grisebach's hand "[Passiflora] divaricata m." I have chosen the last element as lectotype.

As a synonym of *Passiflora pulchella*, Killip

(1938) cited the ineffectively published name *Passiflora subtriangularis* [no rank] *beta* S. Calderón, Datos Bot. Médica El Salvador (Passifloras Dilobatas de El Salvador) 11, figures 9, 10, plate opp. p. 12. pre-1936. For a discussion of the validity and availability of Calderón's publication, see below under *P. quinquangularis* S. Calderón ex J. MacDougal.

Passiflora cissampeloides J. MacDougal, sp. nov. TYPE: Honduras. Cortés: trail to Cerro Cantilles, Cusuco National Park, 15°30′N, 88°14′W, 1840 m, 18 Mar. 1993 (fr), *T. Hawkins 634* (holotype, EAP; isotypes, HEH not seen, MO, TEFH not seen). Figure 1.

Haec species *Passiflorae guatemalensi* similis, sed ab ea stipulis glandularibus integris vel leviter crenatis, bracteis minoribus, fructu ellipsoideo manifeste stipitato atque seminibus insigniter minoribus distinguitur.

Vine, to 10 m, glabrous throughout; stems terete, glaucous; prophylls of the vegetative bud 2, unequal, 0.9–2.2 × 0.4–0.8 mm, both narrowly ovate, acuminate, entire or rarely with a marginal tooth. Stipules 4–8 × 11–16 mm, depressed-ovate, auriculate, slightly clasping, truncate at apiculate apex, the margin entire to obscurely crenulate and 3- to 6-glandular; petioles eglandular; blades 5–6.5 × 5–6.7 cm, peltate 8–10 mm from margin, entire, not variegated at maturity, widely ovate, at base subtruncate with convex curve in peltate region, obscurely 3-lobed, angle between lateral veins 50°–60°, the lateral lobes ± obsolete, the central lobe acute or bluntly acute; laminar nectaries absent or marginal when present, as 1 or 2 glands borne at edge of peltate region. Peduncles 1 per node, (1.4–)2.0–3.2 cm, uniflorous; bracts 2 at apex of peduncle, variable in size, 6–15 × 9–17 mm, ovate-triangular, free to base, entire or with a very few minute setae proximally, not glandular, acute at apex, green. Flowers "creme color, centre yellow" (*Hawkins 198*), the corona apparently yellow; stipe ca. 3 mm long (to 4.5 mm in fruit); hypanthium 17–18 mm diam.; sepals 11–15 × 12–17 mm, widely oblong triangular, rounded at apex, with no projection; petals 16–17 × 12–13 mm, widely ovate, abruptly narrowed at base; coronal filaments in 3 to 4 series, the outermost 5–8 mm long, linear, the inner 2 to 3 series 3–5 mm long, capitellate; operculum membranous, plicate; androgynophore 8–9 mm, anthers ca. 6 mm; ovary 3–4 × 2–2.5 mm, ellipsoid, glabrous; styles 5 mm long including stigmas. Fruit ca. 8 × 3.5–4 cm including a 1.5–2.0 cm long stipe, ellipsoid, lustrous; seeds 4.5–4.9 × 2.7–2.8 × 1.3–1.5 mm thick, narrowly obovate in outline, campylotropous, the testa reticulate with ca. 60 pits, the chalazal beak inclined toward the raphe.

With a peltate leaf similar to *Passiflora guatemalensis* S. Watson or some lowland forms of *P. hahnii* (Fournier) Masters, and a stipitate fruit like *P. membranacea* Bentham, this new species combines character states from each of the other species in supersection *Hahniopathanthus* (Harms) J. MacDougal & Feuillet, to which this species clearly belongs. From *P. membranacea*, which has leaves peltate only 1–3.5(–5) mm from the margin, peduncles (6.3–)8–14(–17.5) cm long, bracts 2.7–5.0 × 2.5–5(–6.3) cm, and androgynophore (2.7–)3.0–4.0 cm long, it is easily distinguished by the peltate leaf, shorter peduncles, smaller bracts, and much smaller flower. From *P. guatemalensis*, which has dentate-fimbriate stipules with filiform teeth, androgynophore 3.5–5.0(–6.0) mm long, and a nonstipitate fruit or the stipe 1 mm long or less, it differs by the entire or crenate stipules with glandular margins, the longer androgynophore, and the stipitate fruit. It differs from *P. hahnii*, which has bracts 1.9–6.2 × 1.5 × 6.4 cm, peduncles 2.5–7.0 cm, and a fruit stipe of 1–4 mm, in the smaller bracts, usually shorter peduncles, and the stipitate fruit. *Passiflora cissampeloides* has generally smaller bracts than the others in the supersection, and the seeds are markedly smaller than the other known species, which range from (4.6–)5–6.5 × (3.1–)3.3–4.2(–4.5) mm.

Distribution and habitat. Known from Copán and Cortés, Honduras, at 1460–1840 m. The type was collected in moist cloud forest of pine, *Liquidambar*, *Podocarpus*, and *Quercus*. The paratype is from dense mixed hardwood forest.

Etymology. The peltate leaves of this new species very much resemble species of *Cissampelos* L. in the Menispermaceae, hence the specific epithet.

Paratype. HONDURAS. **Copán:** S slope of Cerro Azul directly N and above Quebrada Grande, 12 km NE of Florida, Cerro Azul National Park, 15°06′N, 88°55′W, 9 Feb. 1992, *T. Hawkins 198* (EAP, MO).

Passiflora cobanensis Killip, J. Wash. Acad. Sci. 14: 111. 1924. TYPE: Guatemala. Alta Verapaz: between Chamá and Cobán, 3000 ft. ["950 m" in protologue], 26 July 1920, *H. Johnson 411* (holotype, US-1083984, photo at F).

Passiflora brevipes Killip, Publ. Carnegie Inst. Wash. 461: 312, plate 2. 1936. Syn. nov. TYPE: Belize. Toledo: Jacinto Hills [ca. 16°09′N, 88°55′W], 400 ft. ["120 m" in protologue], 11 Mar. 1934, *W. A. Schipp 1304* (holotype, F-733685, neg. 52921; isotypes, A not

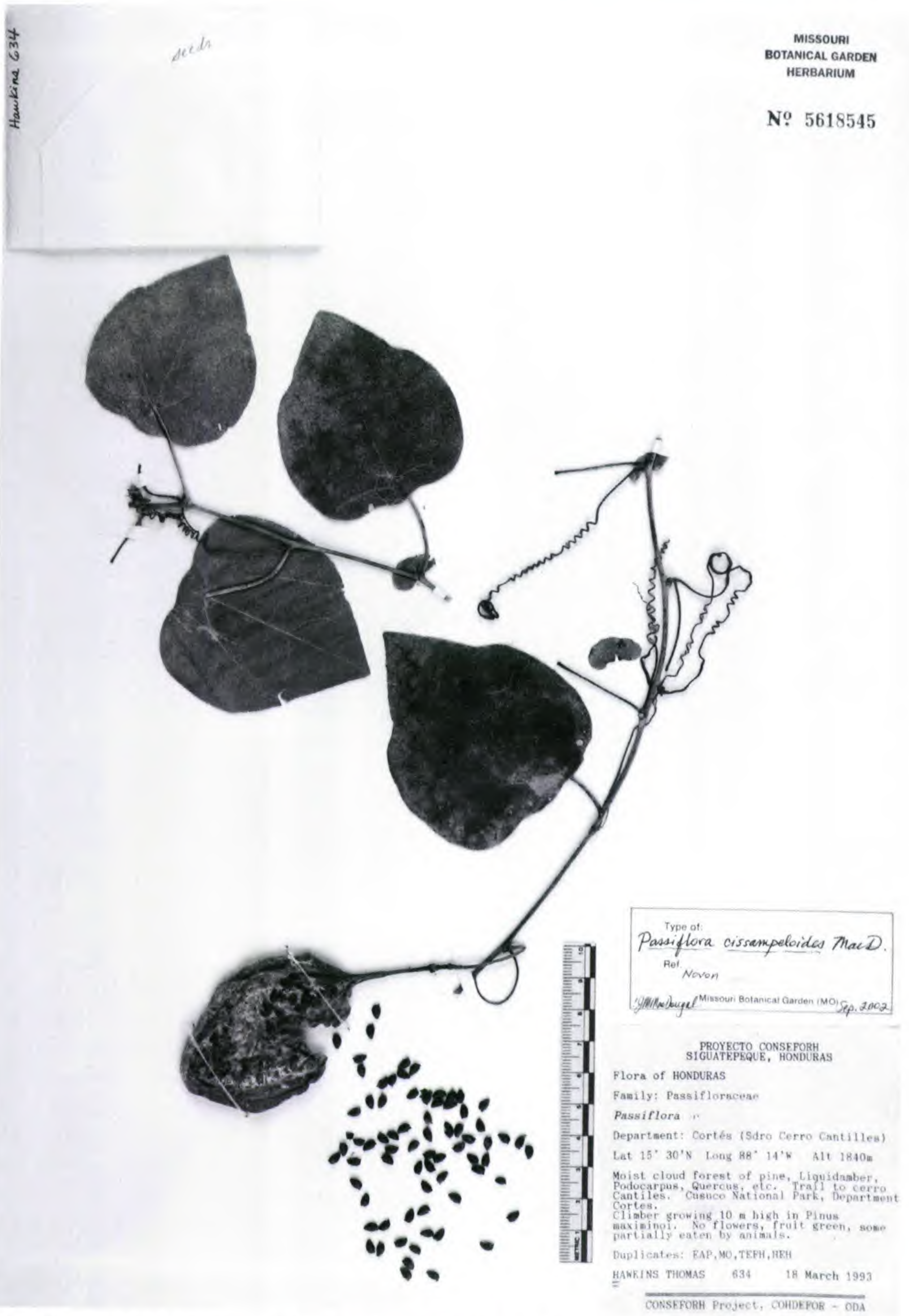

Figure 1. Photograph of the isotype of *Passiflora cissampeloides* at MO.

seen, G not seen, GH not seen, MICH photo at DUKE, MO, NY).

Even at the time of his 1938 monograph, Killip knew both of these passifloras only from their type collections. They are unusual in that they have unlobed leaves in section *Xerogona* (Rafinesque) Killip, a group with otherwise strictly bilobed leaves, and share this leaf shape as a uniquely derived character. The type specimens of the two names represent the extremes in leaf morphology of what

I now take to be single species, *Passiflora cobanensis*. The combined range is the Atlantic lowland humid forest to lower montane rainforest, especially on ridges and limestone outcrops, of Chiapas, Mexico, through central Guatemala to Belize, at elevations of 120–1700 m. The type of *P. cobanensis* represents a mesic to wet upland form, not uncommon in parts of Chiapas, Mexico, with longer, narrower, thinner leaves and less pubescence. The more recent name synonymized here, *P. brevipes*, represents a lowland form from hotter and seasonally drier areas with proportionately wider and thicker leaves and denser pubescence. There does not appear to be a definite geographical disjunction. During the revision of this group for *Flora Mesoamericana*, I have seen a number of well-prepared flowering and fruiting sheets of this species representing both forms and intermediates between them. I have grown and flowered the squat lowland form from Belize. The stem on the lowland form tends more toward triangular, and the floral stipe is often shorter than in the upland form, but I find no basis to Killip's suggestion that the flowers differ significantly, and the fruits and seeds are certainly the same. This is a case of ecological and regional differentiation, but not at a level that deserves species status.

Passiflora hahnii (Fournier) Masters, Trans. Linn. Soc. London 27: 638. 1871. *Disemma hahnii* Fournier, Rev. Hortic. 40: 430, pl. opposite. 1869. TYPE: the cited plate, neotype here designated.

Passiflora cookii Killip, J. Wash. Acad. Sci. 12: 256. 1922. Syn. nov. TYPE: Guatemala. Alta Verapaz: near Finca Sepacuité, 13 Apr. 1902, *O. F. Cook & R. F. Griggs 593* (holotype, US 408302, photo at F).

The protologue of *Disemma hahnii* consists of a diagnosis by Fournier, a discussion and further description of living material by B. Houllet, and a fine color plate. The discussion indicates that the species was sent by Hahn from Mexico in 1857 and grown at the Jardin des Plantes, Muséum National d'Histoire Naturelle, in Paris. I have not been able to locate a type specimen. A suitable type would be a garden-derived element at P labeled in Fournier's or Houllet's hand, rather than one of Ludwig Hahn's widely distributed Mexican collections, most of which were collected later, in 1865–1866. Nevertheless, Killip (1938: 233) cited "Mexico: *Hahn* (K, type collection)"; whether he meant this as a lectotypification or was just following Masters's citations (1871, 1872) is not clear.

In all of his publications, Killip had a mistaken impression of the identity of *Passiflora hahnii*. He obviously never saw the gorgeous and informative colored plate in the protologue of the basionym, which so clearly shows the diagnostic stipules, leaf blades, bracts, and flowers. The true *P. hahnii* has entire (or crenate) stipules, most unlike Killip's key character of "stipules setiferous-toothed" (1938: 49), which is diagnostic instead for the closely related *P. guatemalensis*, a name overlooked by Killip entirely. The circumscription of Killip's *P. cookii* falls within the morphology described for *P. hahnii*. On the other hand, in revising this group for *Flora Mesoamericana*, I have found much variation in *P. hahnii*, including great variation in bract size and number of coronal series. There is some degree of correlation with elevation; e.g., forms represented by the type of *P. cookii*, with a low coronal number and subtruncate laminar base with reduced laminar nectaries, seem to be a lowland variation. I have been unable to separate any taxa from this complex, however, so now treat *P. cookii* as a synonym of *P. hahnii*. This species complex deserves further study.

Passiflora jorullensis HBK var. **salvadorensis** (J. D. Smith) J. MacDougal, comb. et stat. nov. Basionym: *Passiflora salvadorensis* J. D. Smith, Bot. Gaz. (Crawfordsville) 42: 297. 1906. TYPE: El Salvador. San Salvador: San Salvador, May 1905, *L. V. Velasco & J. D. Smith 8887* (holotype, US 941598; isotypes, GH, US).

Passiflora salvadorensis had been maintained as a distinct species by Killip (1938), who distinguished it from *P. jorullensis* HBK on the basis of its pink rather than orange flower, its leaves lobed to below the middle rather than ⅓ their length, and its stems and petioles glabrous rather than puberulent. Additionally, one was supposed to inhabit Mexico, the other El Salvador. We now know from additional collections that the two are so closely related that the flowers are nearly identical and they overlap on many other morphological characters. Except by geography, I am unable to consistently distinguish them. They do usually inhabit different forest types, however, and some morphological differences are correlated with geographical range (see key below), so it seems preferable to distinguish them here as varieties.

KEY TO THE VARIETIES OF *PASSIFLORA JORULLENSIS* IN MEXICO AND CENTRAL AMERICA

1a. Internodes of stems lightly puberulent to pubescent; leaves 2(to sub 3)-lobed ca. ¼–⅓ (rarely to ca. ½) the distance to the base, the lobes acute

to obtuse, rarely somewhat rounded; plants of 1000–1700 m elevation, Nayarit to Guerrero, Mexico . . . . . var. *jorullensis*

1b. Internodes of stems glabrescent; leaves 2-lobed ½ the distance to the base or slightly deeper (rarely only ⅓–½), the lobes obtuse to broadly rounded, rarely subacute; plants of 150–1000 (rarely to 1600 in Chiapas) m, SE Oaxaca, W Chiapas, Mexico, and El Salvador . . . . . var. *salvadorensis*

There is no basis for separation of these taxa by the nearly identical flowers. Both are the same size, with strictly one row of coronal filaments, a 3–4 mm long suberect operculum that is sparsely puberulent basally, and a 9–11 mm long androgynophore. The flowers of both exhibit the same unusual behavior of remaining open more than one day (pers. obs.; Calderón, s.d.). In both, the corona is initially red or a fiery red-orange, which persists for the first day, but changes or fades the second day to purple or purple-pink before closing later that evening or even the morning of the third day. The odor of *Passiflora jorullensis* var. *salvadorensis* is unknown, but the typical variety is famously stinky with a strong odor described as between "stercoraire et putride" by Planchon (1849). A two-day flower is unique among the native species of passifloras in Mesoamerica, and is shared in Mexico and North America only by the red variant of the close relative *P. mexicana* Jussieu. The pollination system associated with this unusual floral behavior is not known. Dennis Breedlove has seen hummingbirds at the flowers of variety *salvadorensis* in Cintalapa, Chiapas, at 1600 m (pers. comm.), wasps have been seen at the flowers of the red *P. mexicana*, and both wasps and hummingbirds at the flower of the related (and also malodorous) *P. gilbertiana* J. MacDougal.

As noted by Killip (1938), the leaf shape is often distinctive, with the leaves of *Passiflora jorullensis* var. *salvadorensis* more deeply lobed and the lobes generally obtuse or rounded, but there is overlap between the varieties. Both occasionally retain some costal variegation into maturity. The leaves of variety *salvadorensis* closely resemble several *Bauhinia* species with which the variety often grows. The differences in vestiture are generally ones of quantity rather than quality: although variety *salvadorensis* often appears glabrous at first glance, close examination reveals a slight puberulence at least on the young growth or around the nodes. The type and other material from El Salvador is particularly glabrescent, with ovaries that are glabrous or very nearly so. In variety *jorullensis*, glabrous ovaries are seen only in the westernmost populations in Mexico.

These two disjunct taxa are usually found in ecologically different forest types. *Passiflora jorullensis* var. *jorullensis* mainly inhabits moist montane oak forest, while variety *salvadorensis* is usually found in subdeciduous or tropical deciduous forest, yet sometimes ranges up to montane moist forest. Neither variety of the species is known from Guatemala or Honduras.

As a synonym of *Passiflora salvadorensis*, Killip (1938) cited the ineffectively published name, *Passiflora subtriangularis* (no rank) *alfa* S. Calderón, Datos Bot. Médica El Salvador (Passifloras Dilobatas de El Salvador) 15, figures 11, 12, plate opp. p. 20, pre-1936. That name is accompanied by a detailed protologue with valuable morphological and ecological information about this variety. For a discussion of the validity and availability of Calderón's publication, see below under *P. quinquangularis* S. Calderón ex J. MacDougal.

Representative specimens examined. EL SALVADOR. **Ahuachapán:** San Benito, al S del pie del cafetal El Naranjo, Co. Davila, *E. Sandoval & Chinchilla 574* (MO). **San Salvador:** San Salvador, *S. Calderón 810* (US); camino al cerro de San Jacinto, 21 July 1959, *E. Montalvo 3662* (ENCB); vicinity of San Salvador, *P. Standley & Padilla 2951* (EAP). MEXICO. **Chiapas:** Mex. Hwy. 190, 13 mi. SE of Tapanatepec, 11 Sep. 1964, *D. Breedlove 7167* (DS, ENCB, F, LL); Arriaga, 13 km N of Arriaga along Mex. Hwy. 195, 25 Sep. 1971, *D. Breedlove 19848* (DS, ENCB, MICH); Cintalapa, SE of Cerro Baul on the border with the state of Oaxaca, 16 km NW of Rizo de Oro along logging road to Colonia Figaroa, 6 Sep. 1972, *D. Breedlove 27627* (DS); Cintalapa, along Rt. 190, 14.7 mi. E of intersection of Rt. 200 to Tapachula, 8 Aug. 1978, vicinity of Tonala, 18 Aug. 1949, *E. Matuda 18783* (F, MEXU); Tuxtla Gutierrez–Jalisco, Sep. 1923, *Purpus 9257* (DS). **Oaxaca:** San Pedro Tapanatepec, along Rt. 190, 5.9 mi. E of intersection of Rt. 200 to Tapachula, 8 Aug. 1978, *J. MacDougal 326* (DUKE).

Passiflora ornithoura Masters var. **chiapasensis** J. MacDougal, var. nov. TYPE: Mexico. Chiapas: Mt. Ovando [15°25′N, 92°36′W], 2000 m, 14–18 Nov. 1939, *E. Matuda 3971* (holotype, MEXU; isotypes, GH, MICH—2 sheets, MO, US). Figure 2.

Haec varietas a varietate typica floribus seminibusque majoribus, foliorum plerumque minus profunde lobatorum lobis lateralibus angulum minorem inter se formantibus atque filamentis coronalibus in seriem unicam dispositis distinguitur.

Herbaceous vine, size unknown but probably 2–5 m, minutely puberulent throughout at the shoot tip (except blades), becoming sparsely puberulent (to glabrescent) below. Stems ± terete, striate, puberulent or sparsely puberulent (rarely glabrescent) below; prophyll of vegetative bud 1, narrowly lan-

Figure 2. Photograph of the holotype of *Passiflora ornithoura* var. *chiapasensis* at MEXU.

ceolate (rarely 3-toothed). Stipules 2–4(–5.5) × 0.2–0.5 mm, linear-triangular or narrowly triangular, subfalcate, usually proximally purple and apically stramineous to necrescent; petioles eglandular; blades (2–)3.5–12(–15) cm long in outline, (1.5–)2.5–5(–8) cm along central vein, (2–)3–8(–9) cm wide, entire, almost glabrous or often very sparsely puberulent basally or on the basal primary veins, sometimes variegated along the lateral veins at maturity, truncate-obovate to very widely obovate

or shallowly obdeltate, 2-lobed 0.08–0.38(–0.58) the distance to the base, or ca. 3-lobed less than 0.2 the distance to the base, the lateral lobes broadly lanceolate to shallowly triangular, acute to obtuse (rounded), the central lobe (obsolete or truncate) obtuse, the central vein always shortest; the angle between the lateral veins (21°–)26°–46°(–62°), the ratio of laminar width to (central lobe) length (0.64–)0.75–1.5(–2.6); laminar nectaries borne between the main veins, often 4 or less on smaller leaves, rarely absent on some leaves of a branch. Peduncles 2 per node, 0.9–2.5 cm, uniflorous; bracts (1–)1.5–4 × 0.2–0.6 mm, linear-triangular to narrowly lanceolate, distally necrescent. Flowers light green to pale green-yellow, the corona reddish or orange basally, orange to yellow apically; hypanthium 5–7 mm diam.; stipe 2.5–5 mm; sepals 9–11.5 × 3–4.3 mm, lanceolate-oblong, with no projection, light green or light green-yellow; petals 4–6 × 1.5–2 mm, narrowly ovate-oblong, pale green; coronal filaments in 1 series, 1.8–3 mm long (or in Guatemala, rarely with a trace of a second inner row), clavate; operculum ca. 1.5 mm long, membranous, plicate, light yellow with tinge of pink; staminal filaments connate 3.5–4.5(–5.0) mm along the purple-pink androgynophore, the free portions 5–6 mm; anthers 2.5–2.7 mm long; ovary 1.2–2.1 × 1.1–1.9 mm, subglobose, glabrous, the styles 6–7.5 mm long including stigmas. Fruit 0.9–1.5 cm diam., globose (to slightly obovate), purple-black, estipitate; arils unknown; seeds 3.1–3.6 × 2.1–2.6 × 1.5 mm, obovoid, transversely sulcate with (6)7 to 9 sulci, the intervening ridges verrucose; seeds per fruit 4 to 25.

KEY TO THE VARIETIES OF *PASSIFLORA ORNITHOURA* IN MEXICO AND CENTRAL AMERICA

1a. Leaves 2-lobed 0.08–0.38(–0.58) the distance to the base, or 3-lobed less than 0.2 the distance to the base, the angle between the lateral veins 21°–46°(–62°), the ratio of laminar width to central vein length 0.64–1.5(–2.6); floral stipe 3.3–5 mm; sepals 9–11.5 mm; coronal filaments 1-seriate (or rarely with a trace of second, inner row) . . . . . var. *chiapasensis*

1b. Leaves 2-lobed (0.48–)0.65–0.90 the distance to the base, the angle between the lateral veins 35°–75°(–81°), the ratio of laminar width to central vein length 2.4–10(–15); floral stipe 1.4–3.5 mm; sepals 6–8.5 mm; coronal filaments 2-seriate (the inner row often reduced and inconspicuous) . . . . . var. *ornithoura*

Passiflora ornithoura var. *chiapasensis* differs from the typical variety of *P. ornithoura* Masters primarily in having larger flowers and seeds, the coronal filaments in only one series, and leaves that are usually less deeply lobed, with a smaller angle between the lateral lobes. There is only slight overlap in leaf shape with the typical variety, and thus the varieties can usually be identified in the absence of flowers or seeds (see key above). The laminar nectaries often number five or less per leaf, and can be reduced to the point of absence on some but not all leaves of a particular flowering branch (e.g., *Téllez & Pankhurst 6983*). Reduction in laminar nectaries is also sometimes found in forms of the typical variety (e.g., the type specimen, *J. Donnell-Smith 2143*, of the synonym *P. dicthophylla* Masters). Leaves of some collections of *P. ornithoura* var. *chiapasensis* bear an amazing resemblance to deeply lobed forms of *P. gilbertiana* or narrow-angled *P. apetala* Killip from Costa Rica, while others, especially the strongly variegated ones, closely resemble *P. boenderi* J. MacDougal. All these related southern Mesoamerican species have different flowers.

The flowers, light green with a mix of red, orange, and yellow, appear to be similar to the typical variety in coloration, but they are slightly larger. Although *Passiflora ornithoura* var. *ornithoura* always has two coronal rows, the inner row is sometimes reduced to only a few very small filaments. The new variety appears to have lost the inner row entirely in most populations; only in one specimen from Chimaltenango, Guatemala, was a second row seen, this reduced to only a few tiny members (*Johnston 1107*, EAP, but not the specimen at F). This variation in the expression of the inner coronal row is similar to that noted in the related *P. gilbertiana* (MacDougal, 1989).

The distribution and habitat of the two varieties show their adaptation to slightly different conditions. *Passiflora ornithoura* var. *chiapasensis* is a wet, cool montane entity, mostly from bosque mesófilo de montaña (moist montane forest) at 1800–2500 m from Chiapas, Mexico, and nearby Guatemala, with one record from Honduras. In Chiapas, Mexico, it is associated with *Magnolia*, *Quercus*, *Pinus*, *Matudaea*, *Billia*, *Styrax*, *Podocarpus*, *Turpinia*, and *Saurauia*. In contrast, the typical variety is commonly found in seasonally drier forest, even thickets in open grassy woodland, from 1200 to 1800 m, rarely to 2200 m. The geographic ranges of the two varieties are adjacent, with variety *ornithoura* apparently nested allopatrically within variety *chiapasensis*. At present, *P. ornithoura* var. *ornithoura* is known definitely only from central Guatemala and El Salvador, with one questionable record from Jinotega, Nicaragua (*P. Standley 10970*, F).

I am tempted to recognize this new entity as a species, especially given the marked ecological di-

vergence, but there is remarkably little well-preserved floral material among all the sheets of both varieties. The flowers, though apparently different in size and very similar in color, are actually poorly known due to the poorly prepared material.

The type locality and its flora were featured in an article by Matuda (1950), and the type specimen was cited there as *P. ornithoura* [as "*ornitheura*"]. The only other passionflower Matuda reported from the mountain was *P. rugosissima* Killip, growing about 200 m lower in elevation.

Phenology. Flowering and fruiting September to December, with fruiting continuing into February.

Etymology. The varietal epithet recognizes the state of Chiapas, Mexico, and the Sierra Madre de Chiapas mountain chain where the holotype was collected.

Paratypes. GUATEMALA. **Chimaltenango:** 8 mi. W of Patizicía on hwy. from Patzún, 14 July 1977, *T. Croat 41080* (MO). **Escuíntla:** Calderas, 24–25 Oct. 1937, *J. R. Johnston 1107* (EAP, F); region of Los Positos, above Las Calderas, 16 Dec. 1940, *P. Standley 80276* (F). **San Marcos:** en el camino Talquián–Cima del Volcán Tacaná por la vereda de los trigales, 19 Oct. 1985, *Martínez et al. 14076* (MEXU, MO). MEXICO. **Chiapas:** SE side of Volcán Tacaná above Talquián, 12 Nov. 1972, *D. Breedlove 29478* (DS); Siltepec, ridge above Siltepec on road to Huixtla, 18 Jan. 1973, *D. Breedlove & Smith 31973* (DS, MO); 9.5 km SW of El Rosario along road to Ojo del Agua & Niquivil, 6 Nov. 1986, *D. Breedlove 65626* (CAS); along S slopes of Sierra de Soconusco to crest, betw. Cañada Honda to El Triunfo, 6 Nov. 1945, *E. Hernández Xolocoti & A. J. Sharp X-352* (DS, MEXU); Unión Juárez, en el camino Talquián–Cima del Volcán Tacaná, rumbo a la línea divisoria con Guatemala, 20 Oct. 1985, *Martínez et al. 14159* (MEXU, MO); Siltepec, Jan. 1937, *E. Matuda 928* (MEXU, MICH); Huixtla, Pizarrén, a 17 km al NW de Motozintla de Mendoza, camino a Siltepec, 20 Sep. 1983, *Téllez & Pankhurst 6983* (MEXU, MO, WIS). HONDURAS. **Lempira:** Guamil, alrededor de El Súcte, 7 km al NE de San Manuel Colohete, en el Parque Nacional de Celaque, 16 Feb. 1993, *Mejía 286* (BM, EAP, HEH, MO, TEFH).

Passiflora platyloba Killip var. **pubescens** (Grisebach) J. MacDougal, comb. nov. Basionym: *Passiflora serrulata* [var.] *β. pubescens* Grisebach, Bonplandia 6(1): 7, 15 Jan. 1858. TYPE: Panama. *Duchassaing s.n.* [1850–1851] (lectotype, designated here, GOET).

Passiflora platyloba var. *williamsii* (Killip) A. Gentry, Ann. Missouri Bot. Gard. 63: 342. 1976. Syn. nov. *Passiflora williamsii* Killip, J. Wash. Acad. Sci. 12: 262. 1922. TYPE: Panama. Coclé: Bismarck, above Penonomé, 600–925 m, 5–19 Mar. 1908, *R. S. Williams 585* (holotype, NY, photo at B, US).

The species group of *Passiflora* centered around the well-known *P. maliformis* L. extends into lower Mesoamerica from northern South America. Two Mesoamerican species were recognized by Killip (1938), *P. platyloba* Killip from Guatemala to Costa Rica, and the rare *P. williamsii* from Panama. Gentry (1976) concluded that separation at the species level was not warranted, and reduced *P. williamsii* to a variety of *P. platyloba*.

At the varietal rank the correct name is *Passiflora platyloba* var. *pubescens*. Grisebach (1858) described the taxon as variety *pubescens* of *Passiflora serrulata*, but Killip (1938), seizing upon certain inconsistencies in the protologue, put this name in synonymy with *P. vitifolia* HBK and erroneously designated for it a type at P that is the wrong species. The three-lobed leaves of the two are superficially similar. A close reading of Grisebach's protologue (1858: 7) shows it to perfectly and accurately describe the taxon we know as Killip's *P. williamsii*, but at the end there is the confusing note [translated from the Latin] "–the flowers, according to a colored painting by Duchassaing, appear to be the same shape and color as *P. vitifolia* Kunth." *Passiflora vitifolia* has large bright red flowers, unlike any other passionflower in Central America. Without Grisebach's original material before him, Killip relied only on the protologue and gave more weight to the reference to the colored painting than to the rest of the protologue. Finding a Duchassaing specimen of *P. vitifolia* at P, Killip decided it was the type of Grisebach's *P. serrulata* var. *pubescens*.

The specimens in Grisebach's personal and original herbarium at GOET tell a different story, and require the selection of a lectotype from among the elements conserved there. There are three sheets of the taxon in question, all collected by Duchassaing in Panama. One has unlobed leaves (a known variation of the taxon), is labeled by Grisebach as "*P. serratifolia* L.," and apparently is the basis for his inclusion of that name in his listing of passifloras from Panama (1858: 7). This sheet can be disregarded because neither the inscription nor the form of the leaves fits the protologue. On the remaining two sheets, both originally annotated with the same manuscript name, there are three elements. One sheet has leaves and immature fruits; the other sheet has leaves and floral bracts and buds, and a watercolor painting by Duchassaing pasted to the bottom of the sheet. That painting is of the leaf and scarlet flower of *P. vitifolia*. Grisebach undoubtedly used elements from both sheets to construct his varietal diagnosis, since fruits as well as floral material are mentioned. Only one sheet is marked with the new name, that with the color painting. Besides phrases identical to the pro-

tologue, there is also written there "[*Passiflora*] *serrulata* Jacq. *var. pubescens m.*," all in Grisebach's hand. I have therefore chosen this sheet, with the exclusion of the colored painting, to be the lectotype of *Passiflora serrulata* var. *pubescens*.

Passiflora quetzal J. MacDougal, sp. nov. TYPE: Guatemala. San Marcos: wet mountain forest near Aldea Fraternidad [ca. 14°56′N, 91°52′W], betw. San Rafael Pie de la Cuesta & Palo Gordo, W-facing slope of the Sierra Madre Mountains, 1800–2400 m, 10–18 Dec. 1963 (fl), *L. O. Williams, A. Molina R. & T. P. Williams 25994* (holotype, EAP; isotype, ENCB, photo at DUKE, MEXU, MO). Figure 3.

Haec species characteribus foliaribus *Passiflorae membranaceae* incolis mexicanis similis, sed ab eis bracteis viridulis multo minoribus atque floris androgynophoro brevi distinguitur.

Vine, glabrous throughout; Stems terete, glaucous; prophylls of the vegetative bud 2, unequal, 1–3 × 0.6–1.5 mm, both narrowly ovate, long-acuminate, 3- to 5-toothed or entire. Stipules 10–19 × 10–20 mm, depressed ovate, auriculate, clasping, widely obtuse, abruptly acute and apiculate-mucronulate to abruptly long-acuminate, the margin entire to obscurely crenulate and 8–15-glandular; petioles (1-)2-glandular near or slightly proximal to the middle, the nectaries 0.6–0.8 × 0.4–0.9 mm, narrowed at base or not; blades 7–11.5 × 7.5–11.5 cm, subpeltate 2–3(–3.5) mm from the margin, entire, or glandular-denticulate at very base, not variegated at maturity, very widely obovate to widely elliptic or ± circular, at base extremely shallowly cordate to truncate or slightly rounded, shallowly to obscurely 3-lobed, angle between the lateral veins 40°–55°, the lateral lobes broadly obtuse to rounded or nearly obsolete, the central lobe obtuse or somewhat rounded to truncate; laminar nectaries marginal, 4 or 5 glands borne basally, (0)1 to 8 glands borne just proximal to the lateral veins, and (0)2 to 8 glands borne marginally distal to the lateral veins. Peduncles (1)2 per node, 3.6–5.8 cm, uniflorous; bracts 2 at apex of peduncle, 0.9–1.3 × 1.0–1.3 cm, ovate to widely ovate-oblong, cordate, free to the base, entire, 6- to 12-glandular marginally, obtuse to rounded, apiculate or abruptly long-acuminate, light green. Flowers white to green-white, the coronal color unknown; stipe 2.5–4 mm (to 5 mm in fruit); hypanthium diameter ca. 15 mm; sepals 18–20 × 9–10 mm, oblong triangular, rounded at apex, with no projection; petals 12 × 7 mm, ovate and notably narrowed at base; coronal filaments in 2 to 3 series, the outermost 16–20 mm, filiform, the inner 1 to 2 series 7–10 mm (1 inner series at petals, 2 inner series at sepals); operculum 4.5–5.0 mm, membranous, plicate; limen edge at least 1.5 mm high; androgynophore 8.5–9 mm, the free staminal filaments ca. 6 mm, the anthers ca. 5 mm long; ovary 3.8–4.0 × 2.3–2.5 mm, ovoid-ellipsoid, glabrous; styles at least 9 mm long including stigmas. Fruit ca. 6 × 3.5 cm, ellipsoid, stipe absent or less than 4 mm; seeds 5.3–6.0 × 3.5–3.9 × 2.0 mm, obovate in outline, campylotropous, the testa reticulate with ca. 50 to 60 pits, the chalazal beak inclined toward the raphe.

Passiflora quetzal is assigned to supersection *Hahniopathanthus* in subgenus *Decaloba*, where it exhibits a number of character states primitive for that supersection. This new species vegetatively closely resembles certain forms of *P. membranacea* from Chiapas, Mexico, with subpeltate leaves, a pair of small stalked petiolar nectaries, and abundant marginal laminar nectary glands borne not just at the base of the lamina, but also marginally between the primary veins. These characteristics are primitive in the group, by outgroup comparison. Killip (1938: 23) did not observe glands in this group, stating "in these . . . species there are no nectar-secreting glands in any form . . . ." In reality, extrafloral nectaries are common in this group. The species are polymorphic for the presence and locations of various types of nectaries, and this variation gives valuable evidence about the relationships within each species and within the supersection. In the description above, the leaves lacking the marginal nectaries in some positions were smaller ones; the large leaves on all the specimens bear abundant glands. The flowers are similar to those of *P. guatemalensis* and to forms of *P. hahnii*, but the bracts are smaller. *Passiflora quetzal* does have only two floral bracts, an advanced state in the supersection and in subgenus *Decaloba*. The floral buds are obtusely and shallowly conical, like *P. guatemalensis*. I originally annotated the isotype (ENCB) as "aff. *cookii* Killip," a name now considered a synonym of *P. hahnii* (see discussion above under *P. hahnii*). Several searches at the F herbarium for an expected isotype have been fruitless.

Distribution and habitat. Southwestern Chiapas, Mexico, and adjacent western San Marcos, Guatemala, on western slopes of the Serrania Transístmica, or Cordillera Madre, at 1800–2400 m in wet mountain forest or "bosque mesófilo de montaña" (moist montane forest). The type locality is also the type locality for *Passiflora eglandulosa* J. MacDougal.

Figure 3. Photo raph of the isotype of *Passiflora quetzal* at ENCB.

Etymology. This species is named for that splendor of the forest, the quetzal, and the native trogons that daily perch among the vines at the type locality. Following ICBN Article 23.2 (Greuter et al., 2000), I choose the epithet from the undeclined American English and Central American Spanish word for *Pharomachrus mocino*, the resplendant quetzal, taken from the Nahuatl word *quetzalli*.

Paratypes. MEXICO. **Chiapas:** Unión Juárez, en el

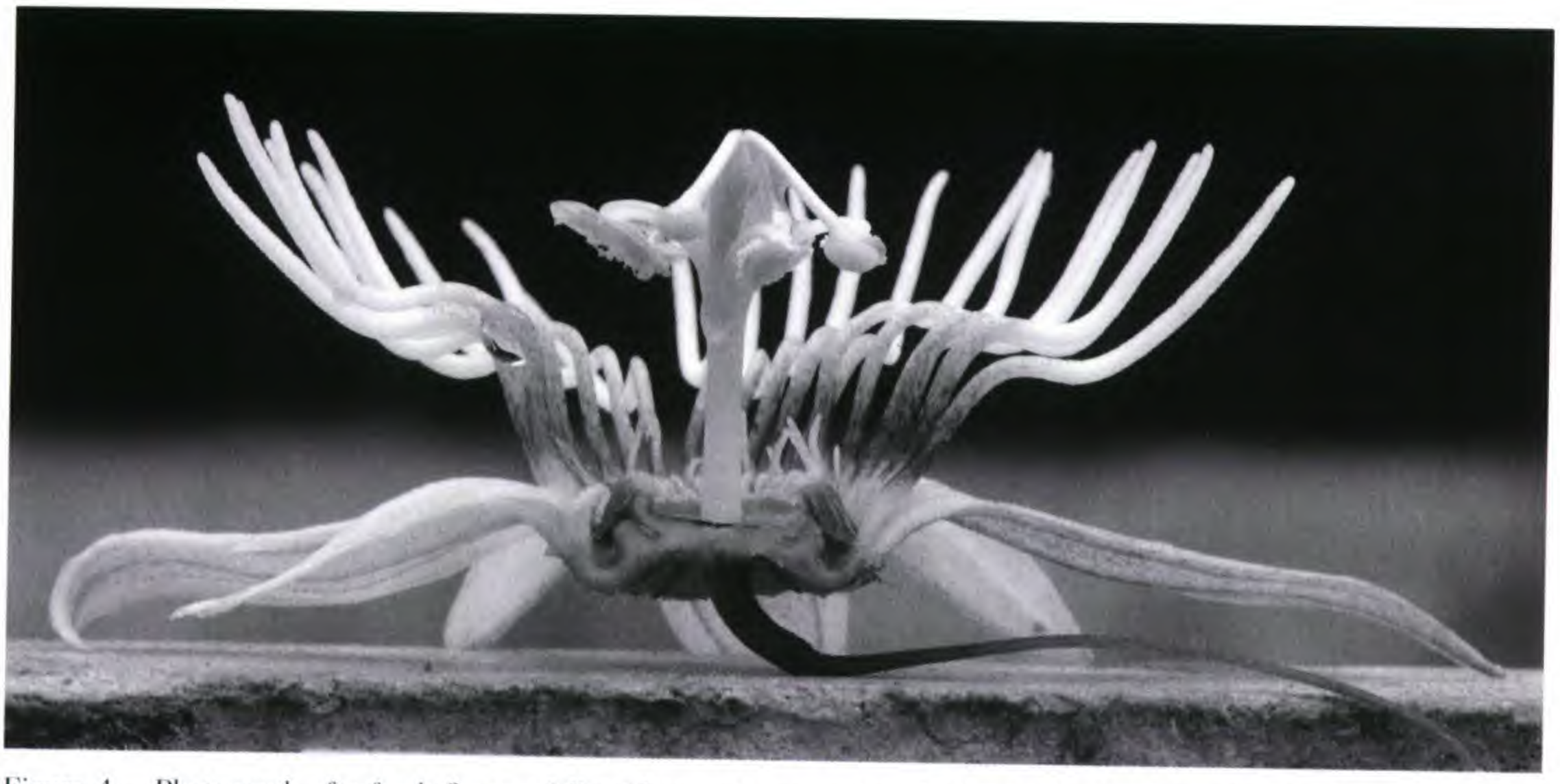

Figure 4. Photograph of a fresh flower of *Passiflora quinquangularis* in longitudinal section showing details of corona and curved floral stipe (*MacDougal 626*, DUKE).

Volcán Tacaná por el camino de Talquián a la cima del volcán, por la línea divisoria de Guatemala, 6 Feb. 1987 (bud, fr), *Martínez S. et al. 19613* (MEXU), *19678* (MEXU, MO).

Passiflora quinquangularis S. Calderón ex J. MacDougal, sp. nov. TYPE: El Salvador. San Salvador: S of San Salvador, July 1922 (fl), *S. Calderón 851* (holotype, US 1151809, photo at MO neg. 05129; isotypes, GH not seen, US). Figure 4.

Haec species *P. rubrae* et *P. capsulari* similis, sed ab eis caule quinquangulari atque alabastris modo araneae ex pedunculis pergracilis (minus quam 0.5 mm in diam.) pendentibus distinguitur.

Vine 2–4 m, herbaceous, or slightly woody at base, pubescent throughout, often densely so at shoot tip, on stem, and abaxial surface of leaves, sometimes the stems glabrescent with age; stems 5-angular, ± cernuous at growing tip, pubescent with trichomes 0.3(0.4–0.6)–0.8 mm long; prophyll of the vegetative bud 1, linear-triangular to very narrowly lanceolate, 2.5–4(–7) mm long. Stipules 4–7 × 0.4–0.9 mm, linear-triangular, falcate; petioles eglandular; blades 4–10(–17) × 4–9(–12) cm, entire, not variegated, widely oblong-obovate (to widely oblong), 2(3)-lobed, the base slightly to strongly cordate, the lateral lobes acute to rounded, the angles between the lateral lobes (30°–)35°–45°(–60°), the central lobe (obtuse) rounded to truncate to obsolete; laminar nectaries absent. Inflorescences sometimes present in older plants as nearly leafless condensed lateral branches; peduncles 1 (very rarely 2) per node, (1.5–)3–5.5(–9.3) cm, very slender, less than 0.5 mm diam., uniflorous, not bracteate; buds abruptly acuminate or short-beaked. Flowers green-white or cream, with a light purple center, the corona white with purple, with fruity sweet odor reminiscent of raspberries; stipe 3–5 mm (to 7 mm in fruit); hypanthium 8–10.5 mm diam.; sepals 15–21(–29) × 5.4–7.0 mm, narrowly triangular, long-acuminate but with no projection, pale green-yellow to yellow-green, abaxially sparsely pilosulous especially on the 3 conspicuous nerves, light yellow-green and often flushed with minute red spots; petals 10–15 × 3.0–4.3 mm, lanceolate, acuminate (or rounded at very apex), white or pale green-yellow; coronal filaments in 2 series, the outer 11–18 mm, filiform, slightly attenuated and white in distal half, light red-purple to purple-red proximally, purple-red basally, the inner 3–4.5 mm, capillary, red-purple, clavate at the paler tip; operculum ca. 2 mm high, membranous, plicate, light purple to medium red-purple, white apically; limen floor very pale red-purple; nectar ring (annulus) present in nectary chamber, ca. 1 mm high, dull purple, not bright yellow; androgynophore (7–)8–10 mm, strictly uncolored except for trace of chlorophyll, the free staminal filaments 4.5–5.5 mm, not colored, anthers 3.7–4.2 mm long, not colored; ovary 2.3–4.0 × 1.7–2.3 mm, ellipsoid, slightly 6-ridged, minutely densely puberulent; styles 5–6.5 mm long including stigmas. Fruit 3–4.5(–6) × 1.5–2(–3) cm, including a ca. 3 mm stipe, broadly fusiform to ellipsoid, conical at both ends or apically with a beak, acutely 6-carinate with keels ca. 1–2 mm high, yellow-green, slightly short-puberulent with trichomes

0.1 mm or less, dehiscent; seeds 3.4–4.0 × 1.7–2.4 mm, transversely sulcate with 6 or 7 (or 8) sulci, the intervening ridges not rugulose.

This species is notable for its long (to 5.5 cm or longer) and diagnostically very slender peduncles (less than 0.5 diam.), upon which the acuminate or short-beaked buds and the flowers are pendent. Due to the curvature of the floral stipe (cf. Fig. 4), however, the flowers face horizontally to open. In *Passiflora*, it belongs to section *Xerogona* (Rafinesque) Killip in subgenus *Decaloba* based on the plicate operculum, absence of laminar nectaries or floral bracts, the carinate apically dehiscent fruit, and the seeds' smooth transverse ridges. Most similar to forms of *P. rubra* L., *P. quinquangularis* differs significantly by its slender floral peduncle and resulting floral orientation, the 5-angled stem, and the only minutely puberulent, not conspicuously pubescent, ovary. Although *P. rubra* does not occur in Mexico or Central America, another close relative does, *P. capsularis* L. This species prefers wetter habitats than *P. quinquangularis*, but in a few places in Guatemala they grow within a km of each other (pers. obs.). *Passiflora capsularis* is easily distinguished from the new species by its pure white or cream, unmarked flower that is borne upward on a stout peduncle, less pubescence overall, and the 3- to 4-angled stem.

As in many species of *Passiflora* subg. *Decaloba*, the vestiture is composed of two different classes of trichomes: very short, curved, cylindrical to clavate antrorsely appressed trichomes 0.08–0.12 mm long (Harms, 1893; MacDougal, 1994), and longer, straighter, pointed ones, in this case 0.3–0.8 mm long. The ovary, for example, has only the short curved type, while most other surfaces of the plant have a mix of the two.

Specimens of this new species have been cited by a number of authors under the name *Passiflora capsularis*, and the descriptions of that species in florulas of Central America, as well as in Killip's (1938) monograph, have included measurements and character states from the new species. The illustration of *P. capsularis* in Standley and Williams (1961), except for the separate fruit, is actually wholly of this species.

A cleared leaf of *Passiflora quinquangularis* from *J. MacDougal 626* (MO) was studied and illustrated by Klucking (1992: 243–244, pl. 96, fig. 3), under the abbreviated names, "P. quing." and "P. quing- -" [sic]. Katie Hansen (pers. comm.) reports that the chloroplast intron rpoC1 is lacking in samples of *J. MacDougal 626* (MO). This clone, imported live from Guatemala in 1980, was grown and widely distributed. It was self-incompatible in the greenhouse. It appears to be the only clone in cultivation even now, and has been listed in many nursery catalogs and illustrated in color in a few popular books (e.g., Ulmer & MacDougal, 2004; Vanderplank, 1996, 2000).

Named for its 5-angled stem, *Passiflora quinquangularis* has its origin in a short obscure publication by Salvador Calderón, a publication that survives by only a single known partial copy. It would have been lost to science except that it was seen and cited by the monographer Killip (1936, 1938) while he worked at the US herbarium. Killip cited both text and figures when, as a synonym of *P. capsularis*, he invalidly published "*Passiflora quinquangularis* Calderón, Passifloras Dilobatas del Salvador 6." A more complete citation would be, Datos Bot. Médica El Salvador (Passifloras Dilobatas de El Salvador) 6, figures 1–8.

Salvador Calderón (1884–1940), a Salvadorian botanist and chief of Agricultural Botany of his country, collected plants in collaboration with Paul C. Standley of the Field Museum for a flora of El Salvador. He was the Salvadorian contact for botanists from the United States in the 1920s and early 1930s, and published articles and booklets between 1925 and 1929 on botany, agriculture, and geology. The seven-page protologue of his *P. quinquangularis* is one of the more detailed ever published for a passiflora, with astute observations on anatomy, phyllotaxy, plant movement, ptyxis, floral morphology, chirality, seed morphology, and more.

The publication that heralded this passionflower was never widely distributed and appears to be generally lost. After much correspondence, I can locate only one partial copy in the reprint collection of the United States National Herbarium at US. It is a booklet with the title *Datos Para La Botánica Médica de El Salvador* and the author's name on the cover. Also on the cover is "Escuela de Medicina, Química y Farmacia/San Salvador, República de El Salvador, América Central." Inside, the work is entitled *Passifloras Dilobatas de El Salvador* and runs from page [1–4 missing] 5 to 20, where the article clearly continues but is not present in this bound copy. There are line drawings and two tipped-in color plates. There is no date. It might have been published during his productive period in the 1920s, an idea also supported by the fact that herbarium specimens (F, US) of all taxa collected by Calderón are dated between 1921 and 1929, with a very few from 1931. Killip cited the publication in both 1936 and 1938; allowing for time in manuscript, Killip may well have seen it before 1935. This date is critical because *P. quin-*

quangularis was published in Spanish, without the Latin diagnosis required after 1934 for valid publication. It probably beats this cutoff date, but it hardly matters, for there is little question that due to the extreme rarity of the publication, the name is not effectively published (Greuter et al., 2000, ICBN Art. 29.1).

The decision that *Passifloras Dilobatas de El Salvador* was not effectively published and distributed invalidates two infrageneric botanical names that were otherwise newly and probably validly published there: "*Passiflora* subsection *Pubescens*" S. Calderón and "*Passiflora* subsection *Raripilus*" S. Calderón. Two other species names are invalidated: the already doubtfully valid "*Passiflora subtriangularis* (no rank) *beta*" S. Calderón [= *P. bicornis*], and the definitely invalid "*Passiflora subtriangularis* (no rank) *alfa*" S. Calderón. This last was published with *P. salvadorensis* J. D. Smith [= *P. jorullensis* var. *salvadorensis*] in synonymy. Calderón made no reference to any of these new botanical names in his two other more widely known botanical publications (Standley & Calderón, 1925, 1941), probably because Killip was a collaborator for the passionflowers there.

Regarding *Passiflora quinquangularis*, Calderón did not cite any specific specimens in his booklet, except to say that his description was based on wild plants found in the highlands around the capital (San Salvador). Only two preserved collections of this species by Calderón are known, and only one, *Calderón 851* (GH, US [2]), is from the area of San Salvador. Killip (1936), treating *Passiflora quinquangularis* as a synonym of *P. capsularis*, rightfully chose this collection as the "type," and in 1938 noted that these specimens were held at GH and US. At one time I thought the name to be valid and effective, and thus in 1989 had annotated one sheet at US as lectotype; to avoid future confusion, I now designate the same sheet to be the holotype.

Distribution and habitat. *Passiflora quinquangularis* is found in seasonally dry forest, brushy hillsides, hedges and secondary vegetation, oak with pine forest, and "ecotone de selva baja caducifolia y bosque mesófilo" (ecotone of low deciduous forest and moist forest) at elevations of 580–1600 m sporadically from Oaxaca, Mexico, to El Salvador, with a disjunct population known from the Nicoya Peninsula of Costa Rica. It is not recorded from Honduras or Nicaragua. Only in El Salvador and southwestern Guatemala does it seem to be common.

Phenology. Flowering and fruiting throughout the year.

Common names. *Ala de murciélago* (*R. Villacorta et al. RV854*), *bejuco calzoncillo* (*J. González 331*), *calzoncillo* (*Calderón 851*), *bejuco calzón de mujer* (*F. Chinchilla s.n.*), *bejuco calzón de hembra* (*J. González 409*). These all refer to the curious shape of the bilobed leaf.

Paratypes. COSTA RICA. **Guanacaste:** La Cruz, Santa Elena, Parque Nacional Guanacaste, 2001, *A. Estrada s.n.* (CR, MO photo). EL SALVADOR. **Ahuachapán:** 1928, *S. Calderón 2428* (F); San Benito, al N del Escobal, Parque Nacional El Imposible, 13°49′N, 89°56′W, 27 Apr. 1994, *F. Chinchilla s.n.* (B, LAGU, MO), *R. Villacorta et al. RV854* (LAGU, MO); near Ataco, 19 Jan. 1947, *P. Standley & Padilla 2644* (F); vicinity of Ahuachapán, 9–27 Jan. 1922, *P. Standley 19733* (MO, NY, US). **La Libertad:** Teotepque, 13°25′N, 89°31′W, 4 May 1996, *J. González 331* (MO); Jayaque, 13°40′N, 89°26′W, *J. González 409* (B, EAP, LAGU, MO, UES); Finca El Paraiso, Jayage, 13 July 1976, *Montalvo 4711* (MO). GUATEMALA. **Baja Verapaz:** Salama Puente Barranca, al W de Salama, 15°06′N, 90°18′W, 24 July 1988, *P. Tenorio et al. 14740* (MO). **Santa Rosa:** Cuajiniquilapa, Sep. 1893, *Heyde & Lux s.n./J. D. Smith 6142* (US); cultivated at Duke University 1980–1984, from live stems collected 27 Jan. 1980, 6 mi. E of rd. to Cuilapa on CA-1, ca. 3 mi. W of intersection of CA-1 with CA-8 to Valle Nuevo, pressed July 1983, *J. MacDougal 626* (BH, BM, COL, CR, DUKE, F, G, GOET, MEXU, MO, MO-spirit, UPCB, US, UVAL); along road SE of Barberena, 21 Nov. 1940, *P. Standley 77729* (F, US); near Cuilapilla, 23 Nov. 1940, *P. Standley 78118* (F). MEXICO. **Oaxaca:** Lachiguiri, cerca a Santiago Lachiquiri, 9 June 1985, *M. Chazaro & M. Leach 3371* (WIS); Juchitan, 1 km al S de Guevea de Humboldt, 16 Mar. 1983, *R. Torres et al. 2521* (MEXU).

Passiflora sexflora Jussieu, Ann. Mus. Natl. Hist. Nat. 6: 110, pl. 37, fig. 1. 1805. *Decaloba sexflora* (Jussieu) M. Roemer, Fam. Nat. Syn. Monogr. 2: 164. 1846. TYPE: Dominican Republic. Santo Domingo, *Poiteau s.n.* (holotype, P).

Passiflora obscura Lindley, Trans. Roy. Hort. Soc. London 7: 48. 1830. Syn. nov. *Decaloba obscura* (Lindley) M. Roemer, Fam. Nat. Syn. Monogr. 2: 157. 1846. TYPE: Cultivated in England from seeds brought from "some part of the North Eastern Coast of South America" by G. Don in 1823, *Herb. J. Lindley* (holotype, CGE, photo at MO neg. 05119).

Examination of type material of *Passiflora obscura* shows this name to be a synonym of the earlier *P. sexflora*. Killip (1938), not having seen this type, aligned the name doubtfully under *P. rubra*. These two species are often vegetatively very similar, with pubescent more or less bilobed leaves with no laminar nectaries, but are unmistakable with fertile material. *Passiflora sexflora* has bracts on the usually branched peduncles, and purple berries, while *P. rubra* has naked, non-bracteate, unbranched peduncles, and a red, pink, or white and red dehiscent berry-like capsule.

Figure 5. Photograph of the holotype of *Passiflora subfertilis* at F.

Passiflora subfertilis J. MacDougal, sp. nov. TYPE: Guatemala. Quezaltenango: betw. Finca Pirineos & Finca Soledad, along stream, lower S-facing slopes of Volcán Santa María, betw. Santa María de Jesús & Calahuaché, 1300–1400 m, 5 Jan. 1940 (fl, imm. fr), *J. A. Steyermark 33503* (holotype, F). Figures 5, 6.

Haec species *Passiflorae biflorae* similis, sed ab ea gemma vegetativa prophyllum unicum gerente, folii lobis

Figure 6. Flowers of *Passiflora biflora* compared to the flower of *P. subfertilis*. From left to right, flowers from three clones of *P. biflora* (Costa Rica, *MacDougal 463* (DUKE); Costa Rica, *MacDougal 464* (DUKE); Guatemala, *MacDougal 598GR* (DUKE)), and flower of *P. subfertilis* (*MacDougal 597GR*). Scale is in cm.

acuminatis acutisve atque petalis sepalisque angustioribus distinguitur.

Vine 2–4 m, minutely puberulent throughout at the shoot tip, or the blades sparsely so, sparsely puberulent to glabrescent below; stem subterete or slightly angular, striate; prophyll of the vegetative bud 1, 1.2–2.0 mm long, narrowly lanceolate, entire, sometimes curved over the bud. Stipules 1.6–2.1 × 0.2–0.3 mm, linear-triangular, falcate, stramineous-necrescent; petioles eglandular; blades 2.8–6 × 5–9.5 cm, in outline obovate to widely obovate, shallowly 2-lobed (rarely sub 3-lobed), the base subtruncate to obscurely widely cordate, the lateral lobes acuminate to acute, the central lobe absent or when present obsolete to obtuse, the angle between the lateral veins 50°–72°, the ratio of laminar width to central vein length 1.1–2.1, not variegated, the margin entire; laminar nectaries numerous but inconspicuous, borne between the main veins; juvenile leaves in outline deeply depressed obovate, deeply 2-lobed, the base broadly rounded to subtruncate, the lobes very widely spreading, lanceolate to narrowly triangular, acuminate, the angle between the lateral veins 70°–115°. Peduncles (1)2 per node, 0.8–1.0 cm, uniflorous; bracts 0.8–2.0 × 0.1–0.2 mm, linear-triangular, early stramineous-necrescent; buds slightly constricted just distal to hypanthium. Flowers white, the corona light yellow; stipe 5–7 mm (to 9 mm in fruit); sepals 13–15 × 6–7 mm, ovate-oblong, pale green abaxially, ± white adaxially, with no projection; petals 10–12 × 4 mm, narrowly oblong, white; coronal filaments in 2 series, the outer 5–6 mm long, slightly laterally compressed, basally yellow-green, distally light yellow, the inner ca. 2.5 mm, capillary, capitellate, near-white with white to green tips; operculum membranous, plicate; androgynophore ca. 9 mm, slightly purple; ovary glabrous, styles and stigmas green. Mature fruit unknown; immature fruit 2–2.5 × 1.5–1.8 cm, widely ellipsoid to widely obovoid, not stipitate; arils unknown; seeds apparently transversely sulcate.

This rare species was known only from two collections made at one place by Steyermark until I went to, or close to, that locality in 1980 and collected it alive. I was then able to cultivate, study, and photograph the species in the greenhouse. Assigned to section *Decaloba* of subgenus *Decaloba*, it is generally very similar to the sympatric *Passiflora biflora* Lamarck. The historic monographer Killip had annotated the two older collections as *P. biflora*, but it may be distinguished easily from that species by having only one prophyll at the vegetative bud and leaves with sharply pointed lateral lobes. The flowers are very similar, but the buds of *P. subfertilis* are constricted distal to the hypanthium, unlike the buds of *P. biflora*. In Figure 6, three clones of *P. biflora* from Guatemala and Costa Rica showing a range of floral variability in that species are compared to a flower of *P. subfertilis*. The flower adjacent to that of *P. subfertilis* is from a *P. biflora* collected at the exact same locality. The petals of the new species are proportionally narrower than those of *P. biflora*. The foliage very much resembles that of the rare *P. sanctae-mariae* J. MacDougal, described from a locality only 1 km distant, except *P. subfertilis* has numerous inconspicuous laminar nectaries. These nectaries can be seen in the cleared leaf from *MacDougal 597GR* (MO) that was studied and illustrated by Klucking (1992: 253–254, pl. 109, fig. 4), as "Passiflora subfertilis [MacDougal]." It also vegetatively resembles *P. helleri* Peyritsch, with which it grows, and the prophyll of the vegetative bud is often curved over in the same way. This species has a floral corona of only one row; however, its leaves have a narrower angle of lobing, from 24°–40°(–50°), and the leaves are

nearly always longer than wide, with a width to length ratio of 0.55–0.85(–1.0). Because the new species resembles the three sympatric species mentioned and is only known from a very small area, I wondered if it might be a hybrid. Hybrids are rare in the genus, but are suspected in the *P. sexflora* Jussieu–*P. rugosissima* Killip complex in Veracruz and Oaxaca, Mexico, and in the widespread Neotropical *P. foetida* L. and *P. ciliata* Aiton complexes. Morphologically, it is not clearly intermediate between any of the three potential parents, though one of the parents would certainly be *P. biflora* (cf. Fig. 6). If it is a hybrid, it is either reproducing or is being regenerated around the type locality, for the plant I found was only a few years old, and probably not a vegetative sprout of the same plant Steyermark found 40 years earlier. In the greenhouse, fresh pollen showed only 40%–50% viability as indicated by lactophenol-cotton blue staining (slide preserved on sheet at MO). Based on this, I give the name *subfertilis*, and although there is some suspicion that it is a hybrid, it is not here published as one.

The type and paratype localities in Guatemala are no more than a kilometer from each other on the Pacific slopes of Volcán Santa Maria, in disturbed primary and secondary regrowth of premontane moist forest at 1250–1400 m. Associated there, besides the species discussed above, are the rare *Passiflora prolata* Masters, and within 1 km, *P. hahnii*. Local vernacular names recorded on Steyermark's labels are *murciélago de montaña* and *granadilla*.

Paratypes. GUATEMALA. **Quezaltenango:** ca. 6 km below Santa Maria de Jesús on Rt. 9S, near km post 196, 19 Jan. 1980 (juv.), *J. MacDougal & Miley 597* (DUKE, F, MEXU, MO, UVAL), [thereafter cultivated at Duke University 1980–1983 as *J. MacDougal 597GR* (DUKE, MO)]; betw. Finca Pirineos & Finca Soledad, along stream, lower S-facing slopes of Volcán Santa María, between Santa María de Jesús & Calahuaché, 5 Jan. 1940 (fl), *J. A. Steyermark 33591* (F).

Passiflora sublanceolata (Killip) J. MacDougal, comb. et stat. nov. Basionym: *Passiflora palmeri* var. *sublanceolata* Killip, Publ. Carnegie Inst. Wash. 461: 322. 1936. TYPE: Guatemala. Petén: Uaxactún to San Clemente, 30 Apr. 1931, *H. H. Bartlett 12788* (holotype, US 1492638; isotype, MICH).

This species has vividly colored flowers variously described as intense rose, bright purple-pink, or hot pink. The androgynophore is long (17–21 mm) and the white or white with pink or purple corona is reduced to 10 mm long or less. It is hummingbird-pollinated, as was documented by Janzen (1968, as undetermined *Passiflora* sp.). From the three specimens known to him, Killip named this as a variety of *Passiflora palmeri* Rose, a white and violet-flowered subshrub endemic to Baja California. We now have abundant material, as well as a better understanding of the habitat differences between the desert in Baja California and the wetter though seasonally dry Yucatán Peninsula, that shows these to be distinct. *Passiflora sublanceolata* is now known from Tabasco, Mexico, to northeastern Belize, and is in cultivation.

Passiflora veraguasensis J. MacDougal, sp. nov. TYPE: Panama. Veraguas: along road betw. Escuela Agricola & Alto Piedra (above Santa Fe) & Río Dos Bocas, ca. 5–8 km from Escuela, 730–770 m, 26 July 1974 (bud, fl, imm fr), *T. B. Croat 25908* (holotype, MO 2292671). Figure 7.

Haec species *Passiflorae nelsonii* similis, sed ab ea foliis bracteisque minoribus, nectariis petiolaribus paucioribus minoribusque atque seriebus coronalibus duabus extimis inter se longitudine accedentibus distinguitur.

Vine, glabrous throughout except the bracts, sepals, and styles; stems terete; prophyll of the vegetative bud 1, widely triangular, obscurely glandular-dentate. Stipules 11–17 × 3.5–6 mm, oblong-lanceolate to oblong-oblanceolate, acuminate to acute, deciduous, both margins glandular-serrulate; petioles not glandular or 1- to 3(to 4)-glandular near or just below the apex, the nectaries 0.8–1.2 × 0.8–1.7 mm; blades 8.5–13 × 6.5–11 cm, entire to obscurely glandular-denticulate especially near the base, not variegated, sometimes glaucous abaxially, (ovate to) widely ovate, unlobed, abruptly acuminate; laminar nectaries marginal, obsolescent except at the laminar base. Peduncle 1 per node, 2.1–4.5 cm, uniflorous; bracts 4.7–5.6 × 2.8–3.2 cm, connate 1.0–1.6 cm at the base, ovate, acute to abruptly short-acuminate, glabrous except for a narrow band of tomentum along the adaxial margin, the margin minutely glandular-serrulate to subentire. Flowers green-white, the corona purple ("dark lavender," *T. Croat 25908*); stipe 10–13 mm, deeply recessed into the hypanthium base; sepals 25–28 mm, the margins and apex sparsely pubescent, the subapical projection 1.5–2.0 mm long; petals ± equal to sepals in length, green-white; coronal filaments in 10 to 11 series, the outermost 17–21 mm, the next 11–13 mm and thicker than the outermost, the inner 8 to 9 series 0.7–3 mm long; operculum 4.7–5 mm long, basally connate and membranous, filamentous in distal ⅔; andro-

Figure 7. Photograph of the holotype of *Passiflora veraguasensis* at MO.

gynophore 8.5–9 mm, anthers 8–9 mm long; ovary 4.5–5 × 3–4 mm, ellipsoid, glabrous; styles short pubescent adaxially. Fruit ca. 6 × 5 cm, widely ellipsoid, exocarp thin, color unknown, not stipitate; arils unknown; seeds 10.0–10.5 × 6.0–7.0 mm, shallowly alveolate with 18 to 25 pits, surrounded by 1–2 mm wide almost winged, flattened margins that are striate-dentate, the prominent chalazal beak antiraphal, the micropylar end notched or retuse.

Passiflora veraguasensis is most like the more

northern *P. nelsonii* Masters & Rose, and like it, is assigned to subgenus *Passiflora*, supersection *Laurifolia* (Cervi) Feuillet & J. MacDougal, series *Tilifoliae* Feuillet & J. MacDougal. *Passiflora nelsonii* ranges from Veracruz, Mexico, to northeastern Costa Rica. *Passiflora veraguasensis* is apparently restricted to Panama. It is generally smaller vegetatively, and differences include the smaller bracts (4.7–5.6 × 2.8–3.2 cm vs. 5.0–7.5 × 3.0–5.0 cm) and petiolar nectaries reduced in number and size (none or 1 to 3, rarely 4 glands vs. 4 or 5, rarely 6 glands that are 1–1.5 mm wide vs. 2–4 mm wide). In the new species, the two outer series of coronal filaments are more similar in length, with the outer twice or less as long (outermost 17–21 mm, the next 11–13 mm). *Passiflora nelsonii* has its outermost coronal row 3 to 10 times longer than the next row (outermost 18–22, the next 1–7 mm).

This new species was discussed by Gentry (1976) under the name *Passiflora tiliaefolia* L., and the present type collection was cited as a range extension of that species from South America. Gentry said the operculum appeared to be entire, but it is actually filamentous for more than half its length. Gentry's misapplied name was repeated in D'Arcy (1987). The butterfly *Heliconius cydno* (Nymphalidae) is recorded on the label of *Knapp 5765* (MO) as an herbivore.

Distribution and habitat. *Passiflora veraguasensis* is found in western Panama near the Continental Divide at 730–1000 m in premontane moist to pluvial forest, at forest edges, and in forest gaps.

Phenology. Flowering April through September, fruiting June through December.

Etymology. The species is named for the Panamanian province of Veraguas, where it was first collected.

Paratypes. PANAMA. **Chiriquí:** al E del sitio de presa en Fortuna, 6 May 1976, *Mendoza 312* (MO). **Coclé:** hills N of El Valle, E slope & ridges leading to Cerro Gaital, 27 June 1982, *S. Knapp 5765* (MO). **Veraguas:** 2/10 mi. beyond fork in road at Escuela Agrícola Alto Piedra on road to Río Calovebora, 3 Apr. 1976, *T. Croat & J. Folsom 33857* (MO); forest & forest remnants to 12 km NW of Santa Fé de Veraguas, 6 Dec. 1975, *W. D'Arcy 10346* (MO).

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New Taxa and Names in North American *Ancistrocarphus*, *Diaperia*, and *Logfia* (Asteraceae: Gnaphalieae: Filagininae) and Related Taxa

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ABSTRACT. *Ancistrocarphus keilii*, a distinctive, rarely collected, previously undescribed, and recently rediscovered species endemic to Santa Barbara County, California, is formally named. *Diaperia* is resurrected for three North American species usually placed in, but clearly distinct from, *Evax*. The name *Evax verna* is neotypified to be consistent with current usage that includes *Evax multicaulis* (as a new synonym), and the new combinations *Diaperia verna* and *Diaperia verna* var. *drummondii* are provided. *Diaperia prolifera* var. *barnebyi*, a long-collected but previously undescribed variety from southeastern New Mexico, western Texas, and southwestern Oklahoma, is also formally named. Among Cassini's anagrammatic segregates from *Filago*, the priority of *Logfia* over *Oglifa* is at best ambiguous, but is adopted to preserve current usage in the Old World, pending a proposal to conserve. A priorable epithet being available, the new combination *Logfia filaginoides* is made for the species long known as *Filago californica* (newly synonymized), including *Filago californica* var. *tomentosa* (also a new synonym). The correct basionym of *Oglifa* is established as *Gnaphalium* subg. *Oglifa*, contrary to earlier interpretations.

Key words: *Ancistrocarphus*, Asteraceae, Compositae, Cassini, *Diaperia*, *Evax*, Filagininae, *Filago*, Gnaphalieae, *Gnaphalium*, *Logfia*, *Micropsis*, North America, *Oglifa*.

During field and herbarium studies of several thousand specimens and populations of Asteraceae subtribe Filagininae Bentham & Hooker f. for a systematic analysis of the subtribe (Morefield, 1992a), for the *Jepson Manual* (Hickman, 1993), and soon for the *Flora of North America* (Flora of North America Editorial Committee, 1993+), several previously undescribed taxa have been named, and the circumscriptions and distributions of certain genera and smaller taxa have been clarified (Morefield, 1992b, 1992c, 1992d). In order to continue this process for the *Flora of North America* project, several new taxa, names, and circumscriptions are proposed or reported herein.

The capitula of Filagininae, though small, are unusually complex for Asteraceae, particularly in the organization of florets and receptacular bracts (paleae; see diagram in Felger, 2000: 101; Morefield & Felger, 2000) and in the minute but systematically important variation of the paleae. For this reason, certain conventions of terminology have been adopted for the upcoming *Flora of North America* treatments and are used here also for efficiency and comparability. The disciform capitula of Filagininae possess two or more outer series of pistillate florets surrounding relatively few, central, functionally staminate or sometimes bisexual florets. The paleae and other structures are referred to according to the sexual condition of their associated florets as, for example, *pistillate paleae* or *staminate corollas* or *bisexual cypselae*. All florets, or at least the outermost pistillate florets, are subtended (and often enclosed to various degrees) by a palea. Each palea often is further differentiated into a central and proximal *body* and a scarious, reflexed, marginal and distal *wing*. The outer pistillate paleae have assumed the involucral function in most species, the true involucre and its phyllaries being present outside the paleae, but usually strongly reduced and/or differentiated, and sometimes vestigial.

The leaves that immediately subtend capitula and/or glomerules are often differentiated, and are termed *capitular leaves*. Branches may also immediately subtend capitula or glomerules; if so, capitular leaves collectively subtend such branches and their capitula, and capitula appear to be sessile in forks of pseudo-dichotomies or -polytomies. Sometimes capitular leaves subtend only glomerules and not individual capitula, and individual capitula may be difficult to distinguish within glomerules.

The descriptions of new taxa herein include all differential traits of systematic significance within

Filagininae, so as to be comparable with previously published descriptions (Morefield, 1992b, 1992c).

Ancistrocarphus Expands

Two peculiar specimens of diminutive, stemless annuals collected in Santa Barbara County, California, by Ralph Hoffmann in the spring of 1929 and labeled as *Hesperevax* (A. Gray) A. Gray were found among the collections of the Santa Barbara Botanical Garden in the late 1980s. Their generic affinities were not immediately evident, and there was considerable doubt that the species still survived amidst the relatively dense human population of its locality after six decades. Further phylogenetic study based on morphology placed the unnamed taxon as the sister species of *Ancistrocarphus filagineus* A. Gray, heretofore the sole species in the genus, with a high degree of confidence (Morefield, 1992a). A recent collection by David J. Keil greatly clarified the distribution and habitat of the species and demonstrated that it still survives in the wild.

Ancistrocarphus keilii Morefield, sp. nov. TYPE: U.S.A. California: Santa Barbara Co., Vandenberg Air Force Base, North Base, Pine Canyon Road betw. Utah Ave. & Lompoc Gate, Burton Mesa Chaparral & coastal live oak woodland, local in minute herb carpet beneath shrubs, 4 Mar. 1995, *D. Keil 24561 & L. D. Oyler* (holotype, OBI 054629; isotype, MO). Figure 1.

Ancistrocarpho filagineo similis, sed caulibus nullis; foliis omnino basalibus valde petiolatis, basibus foliorum valde expansis circum capitula arcte involucratis; paleis staminatis paleis pistillatis plerumque brevioribus nec longioribus, 1.8–2.8 (ad invicem 2.7–4.1) mm longis late spathulatis non lanceolatis; apicibus palearum staminatarum obtusis rotundatisve apiculatis non acuminatis et apiculis scariosis non spiniformibus; cypselis 1–1.4 × 0.5–0.6 (ad invicem 1.4–2 × 0.6–0.9) mm non atrofasciatis; phyllariis vestigialibus; receptaculis obpanduriformibus non fungiformibus; et apicibus palearum pistillatarum alis scariosis indistinctis lanceolatis nec distinctis nec ovatis; *Hesperevaci acauli* var. *acauli* similis, sed receptaculis inter paleas glabris; paleis pistillatis trinervatis saccatis tarde deciduis nec apertis nec permanentibus, unaquaeque cypselam perfecte includenti; basibus palearum staminatarum ad maturitates patulescentibus; et apicibus palearum staminatarum ad maturitates valde incurvatis apiculatis non rotundatis et apiculis scariosis non herbaceis.

Diminutive acaulous annuals 0.5–1(–2) cm high from taproots (sometimes densely clustered, appearing as 1 fibrous-rooted plant), plants grayish green, arachnoid-sericeous throughout. *Leaves* all basal, rosulate, simple, strongly petiolate, up to 10(–18) × 1(–2) mm, longest 3–6× capitula lengths, abruptly differentiated from paleae, or 1 or 2 ± grading into paleae by reduction of blades and expansion of petiole bases, sometimes losing blades altogether and then resembling long-aristate phyllaries; *petioles* mostly 1–3× blade lengths; *petiole bases* strongly expanded, ± parchment-like in texture, yellowish to tan, prominently 3-veined, closely involucrate; *blades* oblanceolate to obovate, ± planar to folded, pliant, entire, uniformly arachnoid-sericeous, primary vein 1, subordinate venation obscure, apices acute to rounded, mucronate. *Capitulescences* 1, unbranched, each consisting of 1 sessile capitulum among leaves, sometimes appearing to form dense leafy glomerules of 2 to 10, but these consisting instead of densely packed 1-headed plants with separate taproots (apparently having germinated in-place from intact capitula of previous year's plants); *capitula* disciform, fully paleate, erect, ± spheric, 2.5–3.5 mm diam.; *involucres* vestigial, functionally simulated by petiole bases and paleae; *receptacles* broadly hourglass-shaped or obpanduriform, 0.9–1.3 mm long, 1–2× as long as wide, glabrous; *paleae* about 10 to 17 in 2 or 3 spirally ranked series, free throughout, veins parallel, not reaching apices, apices shortly glabrous; *pistillate paleae* falling separately (at least upon dissection, tardily so or sometimes not at all in nature), in 1 or 2 series, imbricate, erect to ascending, saccate, 3-veined (central vein thinning, obscure with age, lateral veins remaining prominent), each embracing a floret, ultimately completely enclosing a cypsela, gently incurved, ± ovate, longest 2.3–3.3 mm long, *wings* indistinct, continuous across apices of paleae, incurved (with styles) over staminate florets at anthesis, at maturity ± involute, incurved, shiny, translucent, obscurely striate, lanceolate, entire, glabrous, *bodies* brownish, ± navicular, not gibbous, obcompressed, thinly cartilaginous between veins, abaxial surfaces ± rounded transversely, arachnoid distally near margins or sometimes wholly glabrate, adaxial surfaces arachnoid to thinly lanuginose; *staminate paleae* persistent, 5(to 7), whorled, erect at anthesis, at maturity somewhat expanded, open, concave, obscurely veined, broadly spatulate, 1.8–2.8 mm long, slightly surpassed by pistillate paleae, ± uniformly thickened, cartilaginous, greenish to brownish on both surfaces, abaxially glabrous or distally arachnoid, adaxially arachnoid to thinly lanuginose except for apicula, bases spreading at maturity, ± cuneate to rounded, apices ± strongly incurved, somewhat involute, entire, shortly scarious-apiculate, otherwise obtuse to rounded, neither spinose nor uncinate. *Pistillate florets* 5 to 11 in 1 or 2 spirally ranked series from proximal portions of re-

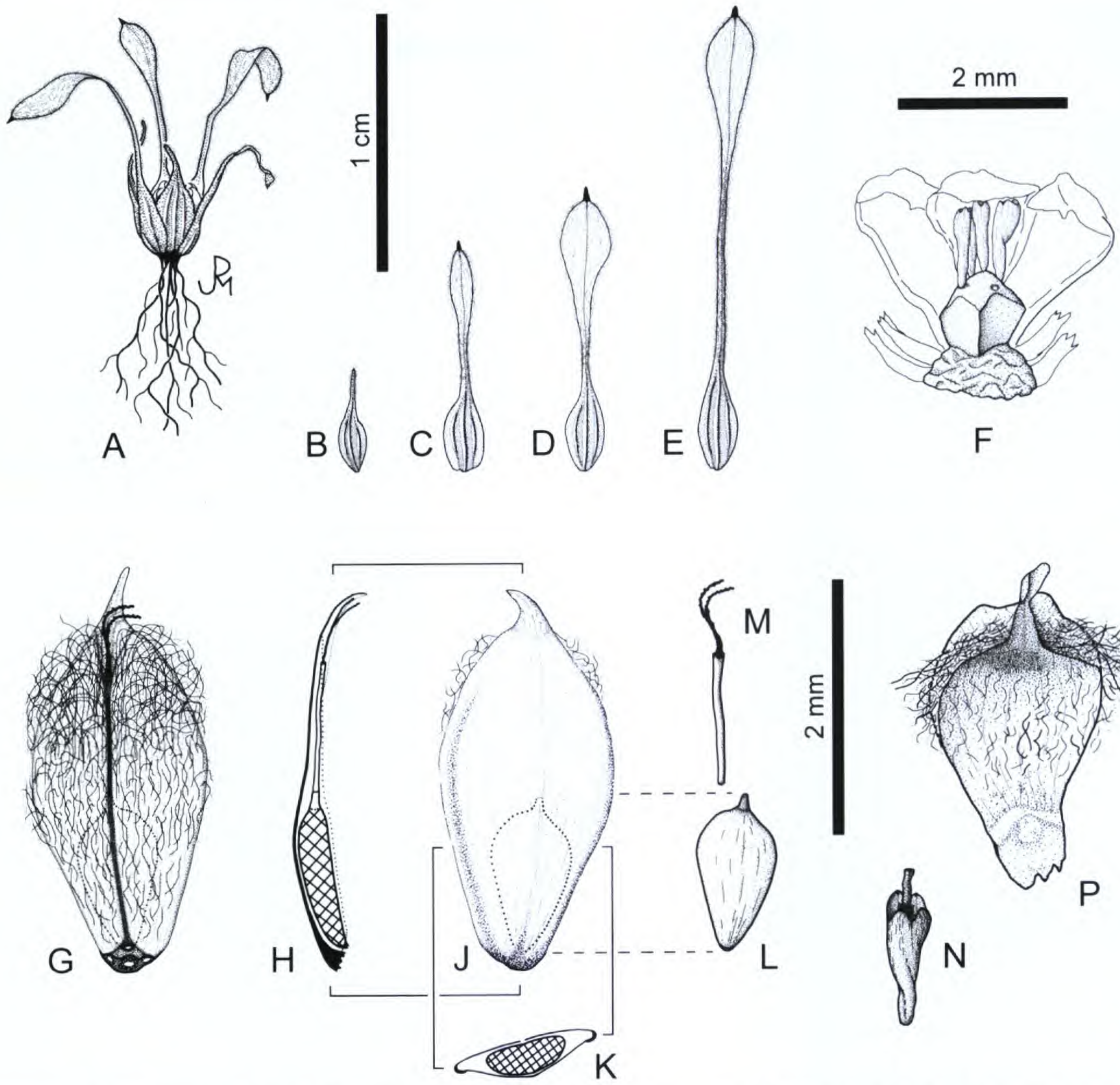

Figure 1. *Ancistrocarphus keilii* Morefield. —A. Plant in late maturity. —B–E. Leaves showing variation in size and shape. —F. Receptacle with staminate florets attached, showing outlines of staminate paleae (two in front removed) and pistillate paleae (bases only, those in front and back removed) in attached positions. G–K, Views of pistillate palea. —G. Adaxial view. —H. Diagram of longitudinal cross section in lateral view. —J. Abaxial view. —K. Diagram of transverse cross section in top view. —L. Mature cypsela, showing position within pistillate palea. —M. Pistillate corolla. —N. Staminate floret. —P. Staminate palea in adaxial view. Drawn from *Keil 24561 & Oyler*, OBI 054629 (B–D, G–P) and *Hoffmann s.n.*, SBBG 063224 (A, E, and F).

ceptacles, each hidden and nearly enclosed by a subtending palea, *pistillate corollas* whitish, filiform, limb absent, styles exserted but surpassed by wings of subtending paleae; *staminate florets* 3 to 6 from receptacle apices, collectively and loosely subtended by whorl of staminate paleae, ovaries vestigial, up to 0.1 mm long, *staminate corollas* ± concealed by pistillate paleae at anthesis, later visible, somewhat bilaterally symmetric, 0.9–1.3 mm long, ± funnelform, glabrous, lobes 4, reddish purple to yellowish brown, deltate, blunt, unequal with 1 or 2 enlarged, stamens included, styles strongly exserted. *Cypselae* each remaining enclosed by a palea, brown, without black band, obovoid, apiculate, not angular, slightly incurved, not gibbous, obcompressed, 1.0–1.4 × 0.5–0.6 mm, glabrous, smooth, dull, corolla scars apical; *pappi* none.

Etymology. The new species is named in honor of David J. Keil (b. 1946) of California Polytechnic State University in San Luis Obispo, consummate student of and expert on the flora of California and the southwestern United States in general (and of Asteraceae in particular) and collector of the holotype. Because *Ancistrocarphus keilii* is likely to become a focus of conservation concern, and appropriate common names are very helpful in such circumstances, the common name Santa Ynez groundstar is here suggested, based on its geographic range and its distinctive habit.

The three gatherings of *Ancistrocarphus keilii* thus far known, including the two historical paratypes cited below, comprise about 180 individual plants. Based on these collections, the species appears confined to the Santa Ynez River drainage of southwest Santa Barbara County, California, where it is known from sandy soils in chaparral vegetation bordering oak woodlands between 40 and 130 m elevation. Plants in reproductive condition have been collected between 4 March and 12 April, and flowering and fruiting therefore likely occur sometime between late February and the end of April or early May in any given year.

In contrast with the five stiffly and inwardly hooked staminate paleae of *Ancistrocarphus filagineus*, the new species has no obvious dispersal mechanism. *Ancistrocarphus keilii* appears to grow annually in dense turf-like associations comprised of dozens to perhaps hundreds of individuals, suggesting that the cypselae germinate more or less in-place from previous years' populations. Lack of dispersal mechanisms is also consistent with the very limited geographic range of the species. It is allopatric with *A. filagineus*, which in Santa Barbara County is found farther inland to the east and north. Unlike many members of the subtribe, no other species of Filagininae have been found mixed with *A. keilii*, suggesting that its habitat is fairly distinctive.

Because of its very limited geographic range and dispersal ability, and its location in a region of relatively dense human population with a strong potential for future impacts, *Ancistrocarphus keilii* should be of immediate conservation concern. Its conservation status should be reviewed and carefully monitored by the State of California, the U.S. Fish and Wildlife Service, Vandenberg Air Force Base, and other appropriate agencies. Because of the small and inconspicuous nature of the plants, surveys resulting from such reviews may well show the species to be somewhat more widespread than current documentation indicates.

In phylogenetic reconstructions based on extensive morphologic data sets, including the new species and all other known taxa of Filagininae, *Ancistrocarphus* consistently resolved as the sister genus to *Hesperevax* (Morefield, 1992a). The two genera share strongly expanded staminate paleae among other features. *Ancistrocarphus* is apparently allied more with the genus *Evax* Gaertner and its segregates than with *Stylocline* Nuttall, where it has frequently been placed by virtue of sharing saccate pistillate paleae. The pistillate paleae of *Ancistrocarphus* differ from those of *Stylocline* and all other Filagininae in having two prominent lateral veins in addition to the central one.

Addition of a second species to *Ancistrocarphus* renders the genus considerably more heterogeneous and partially bridges the gap between it and *Hesperevax* (near *H. acaulis* (Kellogg) E. Greene var. *acaulis* in particular). With the latter genus the new species shares the (often) stemless habit, strongly petiolate leaves, expanded petiole bases (though thinner and 3-veined in the case of *Ancistrocarphus keilii*), vestigial involucre, spatulate and obtuse staminate paleae, proximally expanded receptacle, and somewhat bilaterally symmetric 4-lobed staminate corollas. It is possible that *Ancistrocarphus keilii* is derived from a common ancestor of, or a hybrid between, the two genera. It currently shares the majority of its character states with *A. filagineus*, however, and the two consistently resolved as sister species in all phylogenetic analyses (Morefield, 1992a).

KEY TO *HESPEREVAX* AND THE SPECIES OF *ANCISTROCARPHUS*

1a. Receptacles setose among paleae; pistillate paleae open, obscurely veined, persistent, cypselae falling free; staminate paleae at maturity erect proximally, erect to strongly spreading distally, apices herbaceous throughout, obtuse to rounded . . . . . *Hesperevax*

1b. Receptacles glabrous; pistillate paleae saccate, 3-veined (central vein sometimes thinning with age, becoming obscure), tardily falling, each completely enclosing a cypsela; staminate paleae at maturity spreading proximally, strongly incurved distally, apices at least shortly non-herbaceous, apiculate to acuminate . . *Ancistrocarphus*

2a. Caulescent (usually strongly so); leaves basal and cauline, sessile or broadly and indistinctly petiolate, bases attenuate, not or scarcely involucrate; mature staminate paleae 2.7–4.1 mm long, surpassing the pistillate paleae, broadly lanceolate, apices long-spinose, uncinate, acuminate; cypselae 1.4–2 × 0.6–0.9 mm, with proximal black band; involucres of mostly 3 to 6, minute, scarious, persistent phyllaries; receptacles ± fungiform; apices of pistillate paleae with distinct, ovate wings . . *Ancistrocarphus filagineus*

2b. Acaulous; leaves all basal, strongly petiolate, petiole bases strongly expanded, closely involucrate; mature staminate paleae 1.8–2.8 mm long, slightly surpassed by pistillate paleae, broadly spatulate, apices shortly scarious-apiculate, otherwise obtuse to rounded, neither spinose nor uncinate; cypselae 1–1.4 × 0.5–0.6 mm, without black band; involucres vestigial (simulated by paleae and petiole bases); receptacles obpanduriform; apices of pistillate paleae with indistinct, lanceolate wings . . . . . *Ancistrocarphus keilii*

Paratypes. U.S.A. **California:** Santa Barbara Co.,

Buellton to Lompoc, sandy soil, 30 Mar. 1929, *R. Hoffmann s.n.* (SBBG 063223); Buellton to Lompoc, sandy border of woods, 12 Apr. 1929, *R. Hoffmann s.n.* (SBBG 063224, NY, UC).

Diaperia Departs *Evax*

Three closely similar species of the central United States and adjacent Mexico have usually been placed in *Evax* (or in *Filago* L. when the two genera have been merged). As with *Hesperevax* of California and Oregon (Morefield, 1992c), however, these three species form a monophyletic group only distantly similar to typical *Evax* species (Morefield, 1992a), and they therefore warrant treatment as a separate genus, the earliest available name for which is:

Diaperia Nuttall, Trans. Amer. Philos. Soc. n.s., 7: 337. 1840. *Evax* Gaertner sect. *Diaperia* (Nuttall) A. Gray, Syn. Fl. N. Amer. 1(2): 229. 1884. TYPE: *Evax prolifera* Nuttall ex DC.

Calymmandra Torrey & A. Gray, Fl. N. Amer. 2(2): 262. 1842. *Evax* sect. *Calymmandra* (Torrey & A. Gray) A. Gray, Syn. Fl. N. Amer. 1(2): 229. 1884. TYPE: *Calymmandra candida* Torrey & A. Gray.

Filaginopsis Torrey & A. Gray, Fl. N. Amer. 2(2): 263. 1842. TYPE: *Evax multicaulis* DC. (lectotype, designated by Pfeiffer, 1874: 1347).

Based on phylogenetic analysis of 120 morphologic characters for all known species and varieties of Filagininae, *Diaperia* appears most closely related to *Evax* sect. *Filaginoides* Smoljaninova of the Mediterranean basin and central Asia, and particularly to *Evax eriosphaera* Boissier & Heldreich of the eastern Mediterranean region (Morefield, 1992a). The two groups of species are similar in many ways, but also exhibit several differences that likely justify placing *Evax* sect. *Filaginoides* in yet another genus separate from *Evax* (no name at that rank is yet available).

Key to *Diaperia* and Related Filagininae

1a. Pappi present on some florets; or pistillate paleae predominantly saccate *or* spreading at maturity; or staminate paleae absent *or* spreading at maturity *or* adaxially hairy . . . . . other Filagininae

1b. Pappi absent on all florets; pistillate paleae predominantly open, flat to loosely folded, remaining erect; staminate paleae present, remaining erect, glabrous or abaxially hairy.

2a. Paleae persistent, free throughout . . . . . *Evax* (excluding sect. *Filaginoides*)

2b. Paleae falling, staminate and at least inner pistillate ones as a unit, cohering distally by dense tangled hairs.

3a. Staminate paleae about equaling pistillate paleae, open throughout, apices acuminate or cuspidate, very shortly glabrous distal to pubescence, ± hyaline, erect, not forming cavities in the mass of hairs; plants always compact, less than 3 cm high, pulvinate to rounded . . . . . *Evax* sect. *Filaginoides*

3b. Staminate paleae slightly enlarged, becoming ± closed proximally, apices obtuse, sericeous-lanuginose to tips, ± herbaceous, somewhat spreading at maturity, thereby forming obconic cavities in the mass of hairs; plants usually with well-developed stems 3–25 cm high, simple or loosely branched . . . . *Diaperia*

Diaperia consists of the following three species and two additional varieties of the central United States and northern Mexico, for which typification and current nomenclature are here established, and of which one variety is described as new.

Diaperia candida (Torrey & A. Gray) Bentham & Hooker f., Gen. Pl. 2(1): 298. 1873. *Calymmandra candida* Torrey & A. Gray, Fl. N. Amer. 2(2): 262. 1842. *Evax candida* (Torrey & A. Gray) A. Gray, Syn. Fl. N. Amer. 1(2): 230. 1884. *Filago candida* (Torrey & A. Gray) Shinners, Sida 1: 252. 1964. TYPE: U.S.A. Texas: s.d., *T. Drummond 177* (holotype, GH; isotypes, BM[3], CGE, GH, K[2], OXF).

Some of the type sheets are dated 1835 or 1836, but these apparently reflect the years various sets were received, since Thomas Drummond died in Cuba in March 1835. The plants on all the sheets appear to be of the same gathering. The notation of "San Filipe" on one sheet at K could refer to locations in present-day Austin or Hidalgo Counties, Texas, both areas having produced more modern specimens of *Diaperia candida*. The species occupies a limited range covering eastern Texas and the adjacent corners of southwestern Arkansas, northwestern Louisiana, and southeastern Oklahoma.

Within *Diaperia*, *D. candida* is aberrant in its bisexual disk florets and its reported chromosome complement of $2n = 7II$ (Keil & Pinkava, 1976) and might eventually justify resurrection of the monotypic genus *Calymmandra* (see above), though I hesitate to propose this without further study. The chromosome count is of particular interest, as all of the other 25 counted species of Filagininae have $2n = 14II$ (representatives of *Evax*, *Filago*, *Logfia* Cassini, *Micropus* L., *Psilocarphus* Nuttall, and *Stylocline*) or $2n = 13II$ (a few *Diaperia* and *Evax*). This might imply that the vast majority of Filagininae are tetraploid with *Diaperia candida* being an ancestral diploid, a hypothesis with no phylogenetic support (Morefield, 1992a). It is also possible that Keil and Pinkava (1976) accidentally

mis-translated a meiotic count of $n = 14$ to a mitotic equivalent of 7II instead of 14II.

Diaperia verna (Rafinesque) Morefield, comb. nov. Basionym: *Evax verna* Rafinesque, Atlantic J. 6: 178. 1833. *Filago verna* (Rafinesque) Shinners, Sida 1: 253. 1964. TYPE: U.S.A. Louisiana: Claiborne Parish, Salem Cemetery E of La. 9 in Athens, Sec. 6, T19N, R6W, 5 May 1979, *R. D. Thomas et al. 64261* (neotype, designated here, NLU 157605; isotypes, COLO 388762, NY, RSA 301867, UT 107742, UTEP 20825, VDB 185027).

Evax multicaulis DC., Prodr. 5: 459. 1836. Syn. nov. *Diaperia multicaulis* (DC.) Nuttall, Trans. Amer. Philos. Soc. n.s., 7: 338. 1840. *Filaginopsis multicaulis* (DC.) Torrey & A. Gray, Fl. N. Amer. 2(2): 263. 1842. *Filago nivea* Small, Bull. Torrey Bot. Club 24: 333. 1897, non *Filago multicaulis* Lamarck, Fl. Franc. 2: 59. 1779. TYPE: U.S.A. Texas: "in campis Sn Fernando de Bexar," June 1829, *J. L. Berlandier 2109* (lectotype, designated here, G-DC, IDC microfiche 800. 906.III.4 at RSA).

The name *Evax verna* Rafinesque (1833a) was heretofore of uncertain application. De Candolle (1836: 459) mentioned the name (misspelled as "*Evax vera*") under "species dubia" at the end of his *Evax* treatment, noting "an huic generi adnumeranda?" ("perhaps to be counted with this genus?"). Torrey and Gray (1842: 263) cited *Evax verna* in synonymy with their (thus incorrect) combination *Filaginopsis multicaulis*, citing only "*Raf.! herb.*" It is unclear from the context whether this citation referred to a specimen seen or just to the reprinted description in *Herbarium Rafinesquianum* (Rafinesque, 1833b). In any case, neither I nor apparently any other subsequent workers have been able to locate original type or lectotype material either at GH or at numerous other herbaria checked, thus necessitating designation of a neotype. Gray's (1884) *Synoptical Flora of North America* recognized *Evax multicaulis* and all the other species now included in *Diaperia*, but did not mention *Evax verna* in any context. Shinners (1964) took up Rafinesque's epithet again without explanation for the species including *Evax multicaulis*, and subsequent workers have used *Evax verna* or *Evax multicaulis* in about equal proportions.

In the absence of any original type material, only Rafinesque's (1833a: 178) protologue is available to guide selection of a neotype: "20. *Evax verna* Raf. Canescens sericea. Caule gracile subramoso Fol. laxis semiamplex. obl. obtusiusc. infimis cuneatis, Fl. solit term. bract. ineq. fol. similis, periantho semiglob. squamis paucis subrot.—Texas & Louisiana, triuncial, fl. white, floscules greenish."

In some respects, Rafinesque's description above does not match the plants de Candolle (1836: 459) named *Evax multicaulis*. In particular [my interpretations in brackets], the traits "fol. . . . semiamplex." (with the leaves . . . somewhat clasping), "fl. solit. . . ." (with the "floscules" [glomerules? capitula? flowers?] solitary), and "periantho . . . squamis paucis subrot." (with the perianth [involucre] . . . with scales [phyllaries] few, subrotund) are not consistent with the type material of *Evax multicaulis*.

It is clear from Rafinesque's "triuncial" (3 inches high), however, that he was probably describing young and incompletely developed material and that, allowing for some misinterpretation of structures, such material could easily have belonged to the same species de Candolle later named *Evax multicaulis*. The largest plants of the young neotype material selected above are about 3 inches high, and their incompletely developed capitular leaves do very much resemble "subrotund scales" of involucres (though the true involucres are vestigial in this species). Based on the description "fl. white, floscules greenish," the term floscules would most likely refer to the glomerules of capitula, and these can indeed be solitary on young plants before they have branched, as they are on several plants of the neotype material. The cauline leaves of the neotype material are slightly expanded near the bases, giving the impression that they could be "somewhat clasping," although these bases are usually planar and not folded about the stem. Given the size of the material that Rafinesque described, then, the neotype selected above is not in serious conflict with the protologue (Greuter et al., 2000, Art. 9.17).

Furthermore, no better fit to the protologue can be found among 3-inch-high plants of any other annual Gnaphalieae (as reasonably implied by Rafinesque's placement in *Evax*) known from Texas and Louisiana then or now, including species of *Diaperia*, *Gnaphalium* L., and *Facelis* Cassini. These species have plants that are not yet in flower when 3 inches high, numerous non-terminal glomerules, involucres that are far from hemispheric, numerous obvious phyllaries that are not subrotund, and/or no structures that could be confused with a few subrotund phyllaries. The only other candidate species that comes close to matching the protologue is *Diaperia candida*, and no workers have ever suggested that *Evax verna* belonged with that species. The neotype above was therefore selected to preserve current and previous application of *Evax verna* to the species de Candolle named *Evax multicaulis*.

Collection numbers appeared on the neotype labels as "64261 & 2122," the second number clear-

ly belonging to L. Lewis or one of the other secondary collectors listed.

The additional type materials of *Evax multicaulis* that I examined, but rejected as lectotype, were: U.S.A. Texas: "in campis area S[an] Antonio de Bexar," variously June 1829 or s.d., *J. L. Berlandier 1958* (syntype, G-DC, IDC microfiche 800. 906.III.5 at RSA; isosyntypes, GH, K, LE, MO, OXF, PH); "Lac de St. Nicolas pres la . . . [illegible] . . . St. Espirit," June 1829, *J. L. Berlandier 1958* (syntype, G-DC, IDC microfiche 800. 906.III.4 at RSA); "in campis S[an] Fernando de Bexar," variously June 1828 or June 1829 or s.d., *Berlandier 2109* (isosyntypes, BM, GH, K, LE). Shinners (1951) took both locations cited in de Candolle's (1836: 459) protologue to be in present-day Texas. All of the type material seen definitely represents the same taxon. Among the three G-DC syntypes found, the location and date information on the lectotype chosen above most clearly matches the protologue. (This is contrary to my earlier annotations of *Berlandier 1958* specimens as isolectotypes, which should now be corrected.)

A specimen of *Diaperia verna* (var. *verna*) at CAS (U.S.A. Texas: "Camp bei la Grange," s.d., *A. Scheele* [or *F. Roemer*?] *s.n.*, CAS 7254 [Hb. A. Prager]) may represent type material of *Filago texana* Scheele. The description of *Filago texana* in the protologue (Linnaea 22[2]: 164. 1849), however, refers to a different plant with bisexual and pappose central florets. The plants named *Micropus minimus* DC., Prodr. 5: 461. 1836, likely also represent this species, but the type specimens examined (Mexico. Monterrey: "pres Monterey," Jan. 1828, *Berlandier 1861*, BM, F [Hb. Delessert photograph], LE) are all too young to be determined with certainty, though no other similar species are known from that state. *Evax nivea* (Small) Cory, Rhodora 38: 407. 1936, is a superfluous combination based on *Filago nivea*. The range of *Diaperia verna* is centered in Texas, and extends to Arizona, Arkansas, Georgia, Oklahoma, Louisiana, South Carolina, and northern Mexico.

I agree with previous workers that the material named *Filaginopsis drummondii* Torrey & A. Gray is best treated as varietally distinct from *Diaperia verna*, necessitating the following combination:

Diaperia verna (Rafinesque) Morefield var. **drummondii** (Torrey & A. Gray) Morefield, comb. nov. Basionym: *Filaginopsis drummondii* Torrey & A. Gray, Fl. N. Amer. 2(2): 263. 1842. *Diaperia drummondii* (Torrey & A. Gray) Bentham & Hooker f., Gen. Pl. 2(1): 298. 1873. *Evax multicaulis* DC. var. *drummondii* (Torrey & A. Gray) A. Gray, Syn. Fl. N. Amer. 1(2): 229. 1884. *Filago verna* (Rafinesque) Shinners var. *drummondii* (Torrey & A. Gray) Shinners, Sida 1: 253. 1964. *Evax verna* Rafinesque var. *drummondii* (Torrey & A. Gray) Kartesz & Ghandi, Phytologia 71: 272. 1991. TYPE: U.S.A. Texas: s.d., *T. Drummond 176* (lectotype, designated by Shinners (1951: 126), GH; isotypes, BM[2], CGE[3], GH[2], K[2], NY[2], OXF, PH).

Among all the type material cited above, the sheet at NY from the Torrey Herbarium and the two of three sheets at GH bearing "*Filaginopsis drummondii*" in what appears to be Asa Gray's handwriting are appropriate candidates for the lectotype specimen. All of the plants on all specimens cited above are uniform in appearance and seem to be from the same gathering. All but the lectotype sheet bear Drummond's collection number 176, likely reflecting a simple omission. The different years (1835, 1836, 1839) appearing on a few sheets doubtless indicate when the specimens were received, since Thomas Drummond died in Cuba in March 1835. Nothing in the protologue supports rejection of any of the three lectotype candidates over the others, so I here follow Shinners's (1951) designation and annotation (as "type") of the unnumbered specimen at GH as lectotype.

Some of the isotypes variously bear "Texas III" or "Third Collection" or "Coll. III," apparently referring to a particular set of Drummond specimens. One of the sheets at K also indicates the location "San Felipe." This could refer to locations in present-day Hidalgo County, Texas, where variety *drummondii* is also documented by two gatherings in 1941, or in Austin County, Texas, whence I have seen no specimens although occurrence there is plausible. The variety occurs along and up to 300 km inland from the Gulf of Mexico in Texas, with a disjunct record in coastal Alabama. It likely also occurs in adjacent Tamaulipas, Mexico.

Diaperia prolifera (Nuttall ex DC.) Nuttall, Trans. Amer. Philos. Soc. n.s., 7: 338. 1840. *Evax prolifera* Nuttall ex DC., Prodr. 5: 459. 1836. *Filago nuttallii* Shinners, Sida 1: 253. 1964, non *Filago prolifera* Pomel, Nouv. Mat. Fl. Atl. 1: 47. 1874. TYPE: U.S.A. Oklahoma: Choctaw Co., Red River at Kiamichi River, prairies, June 1819, *T. Nuttall s.n.* (holotype, G-DC, IDC microfiche 800. 906.III.3 at RSA; isotypes, BM, CGE, GH[2], K[2], NY, PH[2]).

Diaperia prolifera occupies a broad crescent from the intermediate and shortgrass prairies of western

South Dakota and southeastern Montana, south and east to eastern New Mexico, Texas, and southwestern Arkansas, and then to the chalk prairies of southern Mississippi and southern Alabama. The following is a long-collected but previously unnamed variant of *Diaperia prolifera* from southeastern New Mexico, western Texas, and southwestern Oklahoma:

Diaperia prolifera (Nuttall ex DC.) Nuttall var. **barnebyi** Morefield, var. nov. TYPE: U.S.A. New Mexico: Lincoln Co., 12 road mi. E of Picacho Post Office, along draws in dry limestone hills, with *Fouquieria & Dasylirion*, 1440 m, 22 May 1987, *R. C. Barneby 18233* (holotype, NY; isotypes, GH, MO, NMC, RSA, TEX, UTEP).

Diaperiae proliferae var. *proliferae* similis, sed plantis ubique argenteis arcte sericeis non laxe lanuginosis; foliis juxta capitula valde indurescentibus basaliter carinatis et semper erectis involucrum rigidum secondarium formantibus; ramis capitulescentiarum valde ascendentibus erectisve saepe inaequalibus aliquot valde reductis; glomerulis amplissimis 1 (ad 3) (ad invicem 4 ad 40+) capitula continentibus; receptaculis anguste conoideis 0.9–1.1 mm longis 2–2.4 plo longioribus quam latioribus; et paleis pistillatis longissimis 2.5–3.2 (ad invicem 3.3–4.0) mm longis.

Caulescent annuals 3–9 cm high from slender taproots, plants densely and tightly silvery-sericeous throughout; *stems* single, erect, or 2 to 5 from base and strongly ascending, usually branched throughout, rarely simple, slender; *branches* sympodial or sometimes appearing monopodial by reduction or failure of development. *Leaves* basal and cauline, gradually enlarged and congested up stems, alternate, simple, sessile or broadly and indistinctly petiolate, up to 11 × 3 mm; *bases* ± attenuate, herbaceous or becoming thickened and indurate among capitula, 1-veined; *blades* oblanceolate to spatulate or obovate, ± planar to undulate, pliant, entire, uniformly sericeous, primary vein 1, subordinate venation obscure, apices usually obtuse to narrowly rounded; *capitular leaves* generally broadest, often appearing whorled, usually mixed with, subtending, and clearly exserted from between individual capitula in glomerules, abruptly differentiated from phyllaries and paleae, longest 2–10× capitula lengths, *bases* erect, carinate, thickened, indurate, forming rigid secondary involucres. *Capitulescences* 1 to 5, cymiform, sympodial, strictly pseudo-polytomous or dichasiform, or sometimes appearing monopodial by reduction or failure of branch development, each consisting of 3 to 20+ capitula; *branches* all strictly subtending glomerules, arising among capitular leaves, strongly ascending to erect, equal or often unequal with some scarcely or not at all elongating; *capitula* disciform, fully paleate, sessile, borne singly or rarely in dense glomerules of 2 or 3, all terminal at branch forks and apices, ± erect, cylindric to ± ellipsoid, 3.5–4.5 × 1.5–2.0 mm; *involucres* of (2 to)4 to 6 reduced, empty phyllaries similar to and seemingly derived from paleae, otherwise functionally simulated by paleae and capitular leaves; *receptacles* conic, 0.9–1.1 mm long, ± 2× as long as wide, glabrous; *paleae* about 18 to 30 in 4 to 6 spirally ranked series, erect to ascending, free proximally, distally all or at least the inner coherent by tangled hairs, falling as a unit (sometimes tardily so or outermost series persistent), veins parallel, obscure, midveins not reaching apices, apices densely lanuginose to sericeous; *pistillate paleae* in 3 to 5 series, imbricate, mostly open, ± planar to concave, gently incurved, oblanceolate to oblong, longest 2.5–3.2 mm long, *margins* of pistillate paleae continuous with and not abruptly differentiated from bodies, not winged, gradually thinning, ± scarious, shiny, translucent, not conspicuously striate, entire, abaxially lanuginose to glabrous, *bodies* yellowish, not gibbous, somewhat thickened, papery to cartilaginous, abaxial surfaces ± rounded transversely, glabrous proximally, *apices* incurved (with styles) over staminate florets at anthesis, at maturity erect, ± planar to concave; *staminate paleae* about 3, slightly enlarged, open distally, becoming ± closed proximally, concave medially, ± spatulate, mostly 1.5–2.5 mm long, slightly surpassing pistillate paleae at maturity, papery to somewhat cartilaginous, greenish to brownish on both surfaces, abaxially ± lanuginose to tips, adaxially ± glabrous, bases erect, acute to acuminate, apices somewhat spreading at maturity, forming obconic cavities in the mass of hairs, entire, ± herbaceous, obtuse to rounded, neither spinose nor uncinate. *Pistillate florets* 13 to 27+ in 3 to 5 spirally ranked series, ± evenly distributed on receptacle, *pistillate corollas* whitish, filiform, limb absent, styles strongly exserted but surpassed by subtending paleae; *staminate florets* about 3 from receptacle centers, each subtended by a staminate palea, ovaries partly developed, abortive, 0.4–0.6 mm long, *staminate corollas* ± concealed by pistillate paleae at anthesis, later exposed by spreading staminate paleae, radially symmetric, 1.4–2.0 mm long, funnelform, glabrous, lobes usually 4, yellowish brown, deltate, blunt, equal, stamens included, styles not or scarcely exserted. *Cypselae* falling free, light to dark brown, without black band, ± obovoid, obtuse, somewhat angular, ± straight, not gibbous, obcompressed, mostly 0.9–1.2 × 0.5–0.7 mm, gla-

brous, minutely papillate, dull to ± shiny, corolla scars apical; *pappi* none.

Etymology. The new variety is named with gratitude for the late Rupert C. Barneby (1911–2000), who immediately recognized the unusual characteristics of this plant as few before him had, who supplied the type gathering (and the specimens of *Micropsis dasycarpa* discussed elsewhere in this paper), who extended characteristic courtesy and assistance during and beyond my years as a student, and whose eloquent and voluminous lifetime contributions to the systematics and taxonomy of Fabaceae remain a priceless resource and inspiration to students of botany the world over. Barneby rabbit tobacco is here recommended as a common name for this variety, to be consistent with other vernacular names used in the genus.

As is evident from the paratypes cited below, specimens of *Diaperia prolifera* var. *barnebyi* have been known since 1852, but the geographic and ecologic significance of the variation was not previously recognized. Based on all the type material, *Diaperia prolifera* var. *barnebyi* occurs from west Texas to southeast New Mexico and extreme southwest Oklahoma, a range from which variety *prolifera* appears largely absent and which comprises the southwest corner of the species' range. The variety *barnebyi* clearly is the xeromorphic phase of the species and does not appear to be particularly weedy. Both varieties approach the Rio Grande just north of Coahuila, Mexico, and may eventually be documented from that country.

Diaperia prolifera var. *barnebyi* is found on open, dry, shallow, rocky or gravelly soils often derived from limestone or gypsum, sometimes in drainages, disturbed areas, or near other sources of extra moisture, at elevations between about 500 and 1500 m. Based on phenology apparent in the type material, plants of the new variety undergo their reproductive cycles between about mid April and mid June.

The relatively large geographic range of variety *barnebyi* ought to render it fairly invulnerable from a conservation standpoint. There are, however, few recent collections among the type and paratype specimens cited herein, which comprise all specimens currently known to me. Attempts should be made to relocate as many of the historical sites as possible, and to find additional, previously undocumented sites, before the variety is assumed to be secure from extinction.

Where the ranges of variety *barnebyi* and variety *prolifera* overlap in central Texas and Oklahoma, specimens have been collected that are intermediate in characteristics between the two types. Specimens I have examined that are of uncertain varietal placement, and that are explicitly *not* considered paratypes (which are listed farther below), include: U.S.A. **Oklahoma:** Woods Co., near Alva, prairie hillside in old road, 10 May 1914, *G. W. Stevens 3053* (US); 16 mi. W & 3 mi. S of Alva, top of hill, short sparse grass, 17 May 1972, *S. Bellah 71* (BRY). **Texas:** Bandera Co., Mystic Canyon, Dry Canyon Creek 0.5 mi. E of Real Co., limestone plateau, 2200 ft., 4 June 1975, *J. Smith 576* (LL); Bell Co., 4 mi. NE of Salado, calcareous gravel, oak-juniper woodland, 12 May 1953, *H. D. Ripley & R. C. Barneby 11059* (NY); McLennan Co., 3 mi. S of McGregor, 26 May 1946, *C. L. York 46105* (TEX); Menard Co., Menard, 26 Apr. 1933, *H. Mahony s.n.* (TEX); Randall Co., Palo Duro Canyon, 15 June 1929, *B. C. Tharp 6495* (LL, TEX); Terrell Co., Blackstone Ranch, 13 mi. S of Sheffield, cedar-sotol mesa top, 2750 ft., 12 June 1949, *G. L. Webster 244* (MICH, TEX).

Typical material of the two varieties may be separated as follows:

KEY TO THE VARIETIES OF *DIAPERIA PROLIFERA*

1a. Plants loosely lanuginose, grayish to greenish; capitula 4 to 40+ in largest glomerules, receptacles wider than long; capitular leaves proximally pliant to ± rigid, not or scarcely carinate, often ± spreading, loosely involucrate; capitulescence branches mostly spreading to ascending; longest paleae 3.3–4.0 mm long . . . . . *Diaperia prolifera* var. *prolifera*

1b. Plants tightly sericeous, silvery; capitula borne singly or rarely in glomerules of 2 or 3, receptacles ± 2× as long as wide; capitular leaves proximally thickened, indurate, carinate, erect, forming rigid secondary involucres; capitulescence branches strongly ascending to erect; longest paleae 2.5–3.2 mm long . . . . . *Diaperia prolifera* var. *barnebyi*

Paratypes. U.S.A. **New Mexico:** Eddy Co., Guadalupe Mountains, near mouth of Dark Canyon, rocky N slope, 23 Apr. 1932, *H. Wilkens 1591* (PH); Lincoln Co., 3 mi. E of Picacho, draw in limestone hills, caliche gravel, 4800 ft., 2 May 1986, *R. C. Barneby 18068* (NMC, NY). **Oklahoma:** Harmon Co., 5.5 mi. S of Hollis, shallow land, overgrazed pasture with *Prosopis*, 13 May 1950, *U. T. Waterfall 9414* (ARIZ). **Texas:** stony hills of the Pecos, May 1852, *C. Wright 1406* (BM, GH, LE, NY, PH, US); Hardeman Co., 2 mi. W of Acme, gypsum outcrop, 1 June 1957, *D. S. Correll 16528* (LL); Lubbock Co., Lubbock sewer farm, 3 June 1930, *D. Demaree 7752* (GH, LE, MO, MONTU, WIS); Terrell Co., Langtry to Dryden, 14 June 1931, *B. C. Tharp 8814* (TEX).

LOGFIA SURVIVES *OGLIFA*: A TALE OF TWO ANAGRAMS

Since conservation of the genus *Filago* L. with *F. pyramidata* L. as the type (Buchheim & Wagenitz, 1964; Greuter et al., 2000, Appendix IIIA.E.3) there have been, among European workers, two divergent approaches to the circumscription of *Filago* and its relatives. The first approach, exemplified by Wagenitz (1969), has been to recognize a large and heterogeneous *Filago* with several subgenera and

sections, generally including *Evax* (and by implication *Diaperia* and *Hesperevax* of North America, also included in *Evax* until more recently). Justification of this approach has been based on the apparent recombination, in "intermediate" species groups, of various character states distinguishing the type species of *Filago* and *Evax*, and also by the existence of occasional natural hybrids among species of the various subgenera and sections (Wagenitz, 1969).

If applied to North American taxa, this "Wagenitz approach" would immediately require inclusion of *Stylocline*, a close relative of *Filago* subg. *Oglifa* (Cassini) Grenier (Morefield, 1992a), in a yet more heterogeneous *Filago*. By logical extension, *Micropus* would fall next, and thereafter all the remaining genera of Asteraceae subtribe Filagininae would have to be lumped.

I prefer the other approach, first championed by Cassini (1819, 1822) and more recently by Holub (1975, 1976, 1998), that recognizes the various recombinant species groups as smaller, more homogeneous genera. The various combinations of typical *Filago* and *Evax* character states in these groups appear to identify natural and easily recognizable genera (as Filagininae go) that are either monophyletic or minimally paraphyletic and that often exhibit unique synapomorphies (Morefield, 1992a). This approach to classifying Filagininae has been applied to the North American taxa by resurrection and segregation of the genera *Ancistrocarphus* (Morefield, in Hickman, 1993), *Diaperia* (this paper, above), and *Hesperevax* (Morefield, 1992c). Holub (1998: 107) completed the process by transferring to *Logfia* the three North American species traditionally placed in *Filago* (*F. arizonica* A. Gray, *F. californica* Nuttall, and *F. depressa* A. Gray).

I agree with Holub's (1975, 1976, 1998) circumscription of *Logfia* to include *Oglifa* (Cassini) Cassini. When the *International Code of Botanical Nomenclature* (ICBN; Greuter et al., 2000) is applied, however, priority of *Logfia* over *Oglifa* is ambiguous and may need to be established via conservation in order to preserve current usage. When Cassini (1819) first split *Filago* into smaller and more natural units, he named three of them using the anagrams *Gifola*, *Logfia*, and *Oglifa*. Each of these taxa was clearly accepted by Cassini at the time (ICBN, Art. 34.1) and was provided with a description and a clear indication of the type species. Each except *Logfia* was also provided with a clear indication of its rank, *Gifola* as a genus, and *Oglifa* as a subgenus. The type of *Gifola* Cassini belongs to the same genus as the type now conserved for *Filago*.

All earlier workers have interpreted Cassini's (1819: 143–144) subgenus *Oglifa* to have been associated with the genus *Filago*, by the title and context of his article and by his designation of *Filago arvensis* L. as type. A careful reading of Cassini's article, however, shows that he explicitly differentiated subgenus *Oglifa* from a portion of *Gnaphalium* (as translated from the French, from "many true *Gnaphalium*, such as *G. luteo-album*, *sylvaticum* and *uliginosum*"), not from *Filago*, and that he explicitly limited membership in *Filago* to a single species, *F. pygmaea* L. Cassini (1819: 143), therefore, definitely associated his new name with *Gnaphalium* (ICBN Art. 33.1) and validated *Gnaphalium* L. subg. *Oglifa* Cassini, a name not heretofore recognized. Cassini (1822: 564) later validated *Oglifa* at the generic rank.

Validation of *Logfia* in 1819 was questionable, and may not have occurred until 1822. Cassini (1819: 143) began his protologue of *Logfia* by listing the two *Filago* species he included therein, stating that those species belonged in a genus other than *Gifola* Cassini (the latter having been described earlier in the same publication), and listing the differential traits. He then stated (as translated from the French), "I thus join together these two species in a particular genus or subgenus, of which *F. gallica* must be regarded as the type . . .," after which he went on to name and formally describe the taxon *Logfia*.

Even though Cassini (1819: 143) said that the two species of his new taxon "differ generically from *Gifola*," it does not necessarily follow that he was ranking *Logfia* itself as a genus, only that *Logfia* was part (or all) of a genus other than *Gifola*. By designating *Logfia* as a "genus or subgenus," it can be argued that Cassini either (1) published alternate names in 1819 (as allowed by ICBN, Art. 34.2), or (2) expressed taxonomic doubt about the placement of *Logfia* (as allowed by ICBN, Art. 34.1), resulting in no "clear indication of its rank" and leaving it valid but unranked in 1819 (as allowed by ICBN, Art. 35.3). In the first case, *Logfia* was valid at generic rank in 1819 and has priority over *Oglifa*. (*Logfia* was not valid at subgeneric rank in 1819, however, because it was not definitely associated with the name of a genus, both *Gifola* and *Filago* having been explicitly excluded.) In the second case, *Logfia* was validated at generic rank by Cassini (1822: 564) simultaneously with *Oglifa*, and then Lessing (1832: 333) established priority of *Oglifa* over *Logfia* in accordance with ICBN, Art. 11.5.

While I believe that the second case above (application of Arts. 34.1 and 35.3) represents the

more logically rigorous interpretation of Cassini's words, Holub (1975, 1976, 1998; but not Chrtek & Holub, 1963) and the various nomenclatural indices have followed the first interpretation instead, and it would now be nomenclaturally disadvantageous to use *Oglifa* in place of *Logfia*. Therefore, pending a proposal to conserve *Logfia* over *Oglifa* (in prep.), I agree that the consequences of the rules are doubtful in the case of *Logfia* and that established custom should be followed (ICBN, Preamble 10). The nomenclature of *Logfia* is summarized as follows:

Logfia Cassini, Bull. Sci. Soc. Philom. Paris 1819: 143. 1819 [as "genre ou sous-genre"], Cassini, in F. Cuvier, Dict. Sci. Nat., ed. 2, 23: 564. 1822. *Filago* L. subg. *Logfia* (Cassini) Grenier, Fl. Jurass. (2): 431. 1869. *Filago* L. sect. *Logfia* (Cassini) Boissier, Fl. Orient. 3: 248. 1875. TYPE: *Filago gallica* L.

Oglifa (Cassini) Cassini, in F. Cuvier, Dict. Sci. Nat., ed. 2, 23: 564. 1822. *Gnaphalium* L. subg. *Oglifa* Cassini, Bull. Sci. Soc. Philom. Paris 1819: 143. 1819. *Filago* L. sect. *Oglifa* (Cassini) DC., Prodr. 6: 248. 1838. *Filago* L. subg. *Oglifa* (Cassini) Grenier, Fl. Jurass. (2): 430. 1869. TYPE: *Filago arvensis* L.

Xerotium Bluff & Fingerhuth, Comp. Fl. German. (sect. 1) 2: 343. 1825. TYPE: *Gnaphalium minimum* J. E. Smith.

Species of *Logfia* are indigenous to Europe, central Asia, northern Africa, and southwestern North America, and have been widely introduced outside those areas. Combinations under *Logfia* were validated by Holub (1998) for the three North American species listed earlier. When removed from *Filago*, however, an earlier specific epithet becomes available for the species long known as *Filago californica*, and must be used:

Logfia filaginoides (Hooker & Arnott) Morefield, comb. nov. Basionym: *Gnaphalium filaginoides* Hooker & Arnott, Bot. Beechey. Voy. (8): 359. 1839. TYPE: U.S.A. "California": s.d., *D. Douglas s.n.* (lectotype, designated here, K [Hb. Hook]).

Filago californica Nuttall, Trans. Amer. Philos. Soc. ser. 2, 7: 405. 1841. Syn. nov. Non *Filago filaginoides* (Karelin & Kirilow) Wagenitz, Willdenowia 5: 417. 1969. *Oglifa californica* (Nuttall) Rydberg, Fl. Rocky Mts. 914. 1917. *Logfia californica* (Nuttall) Holub, Preslia 70: 107. 1998. TYPE: U.S.A. California: "near Santa Barbara," Apr. 1836, *T. Nuttall s.n.* (holotype, BM [Hb. Nuttall]; isotype, PH 1383).

Filago californica Nuttall var. *tomentosa* Nuttall, Trans. Amer. Philos. Soc. ser. 2, 7: 406. 1841. Syn. nov. TYPE: U.S.A. California: Santa Luis Obispo Co., USFS trailhead area on Hwy. 166 NE of Tepusquet Canyon Rd., 9 Apr. 1998, *D. Keil 26673-A* (neotype, designated here, OBI 055308).

Hooker and Arnott (1839: 359) validated *Gnaphalium filaginoides* as "2. G.? *filaginoides*" (ICBN, Art. 34.1) but designated no type. Specimens were found on sheets at BM, GH, and K, each labeled with some abbreviation or permutation of *Gnaphalium filaginoides*. A Douglas specimen on a sheet stamped "Herbarium Hookerianum 1867" at K is selected here as the lectotype because it is the only candidate definitely seen by one of the authors of the taxon, and was gathered by a frequent collector of Hooker's and Arnott's new taxa. There is also a pencil drawing of the species on the sheet. Two other specimens on the same sheet (*Nuttall s.n.* and *Coulter 352*) also represent the same species. The specimens labeled *Gnaphalium filaginoides* on the sheets at BM [Hb. Nuttall] and GH were not provided with collector names, but are very similar to the lectotype specimen, and may represent isolectotypes.

Filago parvula Torrey & A. Gray, Fl. N. Amer. 2 (3): 432. 1843, was a superfluous name for *Gnaphalium filaginoides*. The indexed name "*Gnaphalium filaginoides* Bojer ex DC." (de Candolle, 1837 [1838]: 219) was not accepted by its author, who validated *Stenocline filaginoides* DC. instead. It is therefore invalid and should be removed from all plant name indices. *Logfia filaginoides* is most abundant in California and adjacent northwestern Mexico, extending eastward across a narrowing triangular area to extreme western Texas.

Other specimens located at GH and K [Hb. Hook.] likely represent additional isotypes of *Filago californica*, but too few label data accompany them to permit certainty. No original material, type or otherwise, could be located for *Filago californica* var. *tomentosa*, nor was any designated in the protologue, necessitating selection of a neotype. The protologue diagnosed the variety as having "leaves crowded and tomentose, flower clusters approximating in spikes," and indicated that both it and variety *californica* were found "near St. Barbara, Upper California." The neotype specimen selected above matches this diagnosis exactly, and is the "nearest" to Santa Barbara of any similar specimens I have seen. It was collected just across the Santa Barbara/San Luis Obispo County line near the Cuyama River (D. J. Keil, pers. comm., 19 Aug. 2004). As neotypified, *Filago californica* var. *tomentosa* appears to represent an occasional ecotype of coastal and chaparral areas, and does not merit taxonomic recognition.

Micropsis Arrives

Micropsis DC. consists of five species native to temperate South America and found variously in moist or dry, often sandy or alkaline soils from central Chile to Paraguay and southern Brazil, south to the Juan Fernández archipelago (Bustamante, 1979; Cabrera, 1963). Its species are unique among Filagininae for their densely long-hairy cypselae and for the saccate, nearly closed, and often lacerate bisexual paleae, and may be only convergently related to the rest of the subtribe. Phylogenetic analysis of morphologic characters (Morefield, 1992a) placed the genus closest to *Stuartina muelleri* Sonder of Australia.

In 1988 the late Rupert C. Barneby sent to me for identification a specimen of Asteraceae from the central gulf coast area of Texas. This turned out to be *Micropsis dasycarpa* (Grisebach) Beauverd, and the name and typification are here newly reported for the *Flora of North America* project:

Micropsis dasycarpa (Grisebach) Beauverd, Bull. Soc. Bot. Genève ser. 2, 5: 224. 1913. *Filago dasycarpa* Grisebach, Abh. Königl. Ges. Wiss. Göttingen 24: 185. 1879. TYPE: Uruguay. Concepción del Uruguay, Oct. 1877, *P. Lorentz 1181* (holotype, GOET not seen; isotypes, G-BOIS not seen, NY).

Of his North American collection (cited below), Barneby (in litt. 9 Nov. 1988) wrote:
"The habitat in Texas is in low swampy ground, and one of the associated herbs is *Mimosa strigillosa* T. & G. The latter has a remarkable bicentric dispersal, around the Gulf of Mexico in US, and in warm-temperate South America chiefly in the Paraná basin. There is no obvious reason to think that the mimosa is not native in both hemispheres—there are a number of xerophytic species with about the same range—and the possibility arises that *Micropsis* is not just a casual introduction but an overlooked native in Texas. The microhabitat where I found it was certainly not pristine Gulf lowland prairie, but that scarcely exists nowadays."

I agree with Barneby that *Micropsis dasycarpa* could be native to Texas. Although its recent discovery in a part of the world relatively well-explored by botanists, and the apparent lack of further collections from the area, would argue against that interpretation for now, the species will be given benefit of the doubt and treated as introduced for the *Flora of North America* project.

North American specimen examined. U.S.A. **Texas:** Victoria Co., N of Inez, colonial in drying mud at edge of pool, in Gulf Coast Prairie, 18 May 1987, *R. C. Barneby 18201* (NY 622020, RSA 475037).

South American specimens examined. PARAGUAY. Villa Florida, 2 Oct. 1892, *O. Kuntze s.n.* (NY); Cerros de Tobaty, Sep. 1900, *E. Hassler 6102* (NY[2]). URUGUAY. Departamento de Colonia, Riachuelo, 1 Nov. 1960, *A. L. Cabrera 18201* (RSA).

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Cinco Especies Nuevas de *Mortoniodendron* (Tiliaceae) para Costa Rica

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Resumen. Cinco especies de *Mortoniodendron* (Tiliaceae) son descritas como nuevas y sus afinidades taxonómicas son discutidas. Estas especies son endémicas de Costa Rica y distribuidas entre el nivel del mar y 1850 m. Tres de estas especies, *M. abelianum*, *M. apetalum* y *M. moralesii*, junto con *M. pentagonum* (Donnell Smith) Miranda de Guatemala, son comparadas entre si debido a sus afinidades en frutos, los cuales son grandes y presentan valvas leñosas y con pared gruesa. También, *M. cauliflorum* y *M. longipedunculatum* son descritos como especies nuevas, ambas son comparadas con *M. anisophyllum* (Standley) Standley & Steyermark por la afinidad presentada en flores y frutos.

Abstract. Five new species of *Mortoniodendron* are described and their taxonomic affinities are discussed. These species are endemic to Costa Rica, where they occur between sea level and 1850 m. Three of these species, *M. abelianum*, *M. apetalum*, and *M. moralesii*, are considered to be close relatives and compared with *M. pentagonum* (Donnell Smith) Miranda from Guatemala, because all have big fruits with thick, woody valves. *Mortoniodendron cauliflorum* and *M. longipedunculatum* are compared with *M. anisophyllum* (Standley) Standley & Steyermark because of their similar flowers and fruits.

Key words: Costa Rica, *Mortoniodendron*, Tiliaceae.

Mortoniodendron es un género con 5–12 especies, distribuidas desde México hasta Colombia (Meijer, 2001).

Este género se caracteriza por sus hojas alternas, tallos con corteza fibrosa, savia mucilaginosa, hábito arborescente o arbustivo, estípulas diminutas, envés usualmente con domacios en las axilas del nervio central y en secundarios, pedicelos generalmente articulados, estambres la mayoría agrupados en 5 falanges, anteras casi siempre mucronadas en el ápice, frutos capsulares, densamente estrellado-puberulentos en la superficie externa y por sus semillas con un arilo generalmente rojo-anaranjado.

Mortoniodendron corresponde a un género poco estudiado taxonómicamente y es común encontrar mucha confusión en sus identificaciones de herbarios. Este género fue descrito (Standley & Steyermark, 1938) sobre la base de *Sloanea anisophylla* Standley (Standley, 1929) de Panamá. Luego posiblemente desconociendo la publicación de *Mortoniodendron*, M. Burret con base en la misma *S. anisophylla* publica lo que él creyó como un nuevo género de Tiliaceae, al cual dio el nombre de *Orthandra* (Burrett, 1940). Posteriormente fueron descubiertas y descritas las siguientes especies: *M. guatemalense* Standley & Steyermark (Standley & Steyermark, 1940), *M. membranaceum* Standley & Steyermark (Standley & Steyermark, 1940), *M. hirsutum* Standley (Standley, 1942), *M. costaricense* Standley & L. O. Williams (Standley & Williams, 1951), *M. ruizii* Miranda (Miranda, 1956), *M. palaciosii* Miranda (Miranda, 1956), *M. pentagonum* (Donnell Smith) Miranda (Miranda, 1965) descrito sobre la base de *Sloanea pentagona* Donnell Smith (Donnell Smith, 1893), luego fue publicado *Westphalina macrocarpa* A. Robyns & Bamps (Bamps & Robyns, 1977) considerada por los autores como un nuevo género monoespecífico, pero hoy incluido en sinonimia de *M. pentagonum* (Dorr, 2001), finalmente son publicados *M. vestitum* Lundell (Lundell, 1965) y *M. sulcatum* Lundell (Lundell, 1968).

Durante el proceso de elaboración del tratamiento de Tiliaceae para el *Manual de Plantas de Costa Rica* cinco nuevas especies fueron encontradas.

1. **Mortoniodendron abelianum** Al. Rodríguez, sp. nov. TIPO: Costa Rica. Puntarenas: Coto Brus, Parque Internacional La Amistad, Cordillera de Talamanca, Estación Pittier, Río Gemelo, 9°1′30″N, 82°57′40″O, 1680 m, 30 ene. 1995, *L. Angulo 21* (holótipo, INB; isótipos, CR, MO). Figura 1.

Haec species inter congeneros fructu valde costato recognoscitur.

Árbol de 3–18 m; ramitas teretes, estrellado-pu-

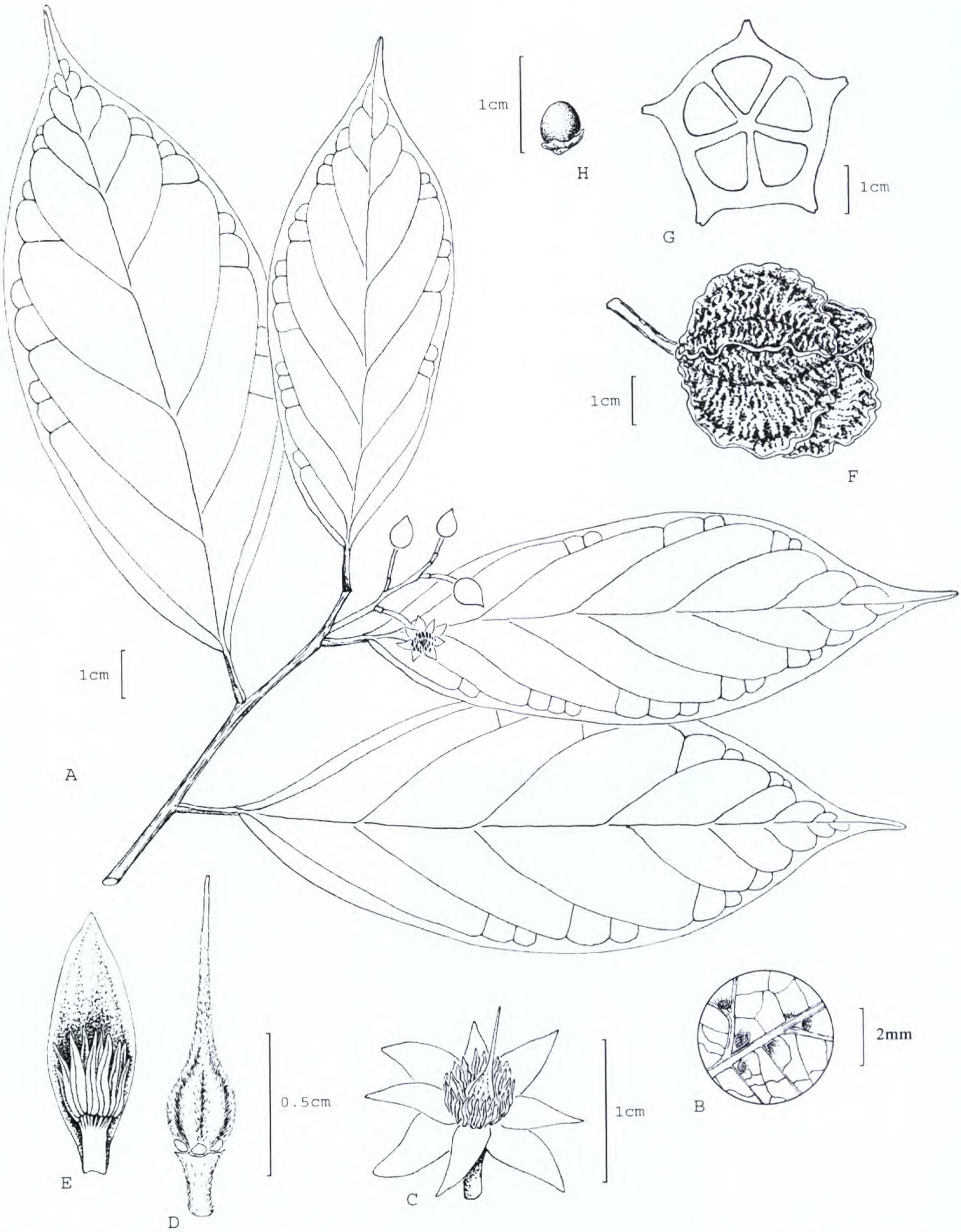

Figura 1. *Mortoniodendron abelianum* Al. Rodríguez (*Angulo 21*). —A. Ramita con hojas e inflorescencia. —B. Domacios. —C. Flor. —D. Pistilo. —E. Pétalo y falange. —F. Fruto. —G. Fruto en sección transversal. —H. Semilla subtendida por el arilo.

berulentas. Hojas con peciolos 4–10 mm, estrellado puberulentos; lámina 7–18 × 3–8.5 cm, elíptica a obovado-elíptica, papirácea, glabrada sobre ambas superficies, esparcido y estrellado-puberulenta sobre el nervio central y los secundarios, ápice acuminado, base cuneada a ligeramente asimétrica, con 5–11 pares de nervios secundarios, 2–4 nervios saliendo desde la base de la lámina, envés usual-

mente con domacios en las axilas del nervio central y en secundarios, glándulas pelúcidas ausentes; estípulas 0.75–1.5 mm, pronto deciduas. Inflorescencias son cimas terminales o axilares, 2–5 cm de largo, con 2–5 flores, ejes estrellado-puberulentos; pedúnculos 0.3–0.8 cm, 2-bracteados cerca de la base, brácteas 0.75–1.25 mm. Flores con pedicelos 7–14 mm, articulados, con bractéolas 0.5–0.75 mm, pronto deciduas; sépalos 4, 9–11 mm, lanceolados, denso y estrellado-puberulentos en la parte externa, esparcido y estrellado-puberulentos internamente; pétalos 4, 7–8 mm, lanceolados, blancos, glabros; falanges 4, opuestos a los pétalos, cada uno con 10 estambres, parte libre de los filamentos 0.25–0.75 mm, anteras 2.25–3.5 mm incluyendo el mucro, oblongo-triangular, desiguales, mucro 0.25–0.6 mm; ovario con 5 fuertes costillas, estilo ca. 6.5 mm, estrellado-puberulento en la mitad basal, glabro en la mitad distal. Frutos 2.5–4.5 × 2.5–4 cm, globosos a ovoides, 5-locular, con 5 fuertes costillas, costillas formadas a lo largo del punto de unión de las valvas, valvas leñosas, pared 4–6 mm de grosor; semillas ca. 5 por lóculo, fértiles o estériles, fértiles ca. 5 mm de diámetro, subglobosas, cubiertas ca. ¼ de su tamaño por el arilo.

Fenología. Flores en julio; frutos entre enero a marzo y en junio.

Distribución. Endémica de Costa Rica, conocida de los bosques nubosos de la Cordillera de Talamanca en la vertiente Pacífica, entre 1600–1850 m.

Mortoniodendron abelianum se reconoce por sus grandes frutos prominentemente acostillados, en ocasiones costillas pareciendo alas, con paredes valvares gruesas y endurecidas, estambres con la parte libre de los filamentos muy corta (igual o menor a 0.75 mm) y por presentar lóculos de los frutos con ca. 5 semillas, entre fértiles y estériles. Muy similar a *M. moralesii* sin embargo, este último tiene tallitos y peciolos estrellado-tomentosos (vs. estrellado puberulentos) y los frutos son nada a leve acostillados (vs. prominente acostillados). También es semejante a *M. anisophyllum* (Standley) Standley & Steyermark, pero se les puede distinguir debido a que este último presenta frutos más pequeños (entre 1–2 × 1–2 cm), la pared del exocarpo es más delgada (hasta 0.5 mm) y su rango de distribución es distinto (1–850 m). *Mortoniodendron abelianum* ha sido erróneamente identificado bajo el nombre de *M. pentagonum* (Donnell Smith) Miranda, una especie restringida a Guatemala (Dorr, 2001), pero esta especie se separa debido a que presenta hojas plinervadas, en la cual el primer par de venas sale hasta 2 mm sobre la base, sus hojas carecen de domacios, sus láminas foliares tienen glándulas pelúcidas, los pedicelos no son articulados, los estambres son libres, biseriados, no en falanges, los pedicelos (2–3 cm), sépalos (15 mm) y anteras (4.5–6.5 mm) son más largos, finalmente debido a que los lóculos de los frutos tienen únicamente una semilla, la cual está cubierta totalmente por el arilo.

El epiteto está dedicado a Abel Rodríguez, mi padre, a quien agradezco su apoyo incondicional en todo momento de mi vida.

Parátipos. COSTA RICA. **Puntarenas:** Coto Brus, Parque Intern. La Amistad, cordillera de Talamanca, Est. Altamira, Sendero Los Gigantes, *Angulo 165* (CR, INB, MO); Est. Biol. Las Alturas, El Tajo, *Aguilar 97* (CR, INB, MO); Est. Pittier, NE de la Estación, *Acosta 2330* (CR, INB, MO); Sendero a Fila Pittier, *Gamboa 2* (INB); Zona Protectora Las Tablas, Sendero a Quebrada Gemela, *Chinchilla 22* (CR, INB, MO); Sitio Las Tablas, *Alfaro 2015* (INB, CR).

2. Mortionodendron apetalum Al. Rodríguez, sp. nov. TIPO: Costa Rica. Alajuela: Laguna Pocosol, Río Peñas Blancas, bosque Eterno de los Niños, 10°21′N, 84°40′O, 840 m, 27 abr. 1992, *B. Haber 11161* (holótipo, INB; isótipos, CR, MO). Figura 2.

Haec species inter congeneros foliis glandulis pellucidis praeditis, flore apetalo atque fructus grandis valvarum lignosarum parietibus crassis recognoscitur.

Árbol 25–50 m; ramitas teretes, estrellado-puberulentas. Hojas con peciolos 9–18 mm, estrellado-puberulentos; lámina 9–19 × 4.5–9 cm, lanceolada a elíptico-lanceolada, coriácea, estrellado-puberulenta, principalmente en ramitas jóvenes, glabrescente con el tiempo, ápice acuminado, base redondeada a leve oblicua, con 5–12 pares de nervios secundarios, 2–4 nervios saliendo desde la base de la lámina, envés usualmente con domacios en las axilas del nervio central y en secundarios, con glándulas pelúcidas; estípulas no observadas, pronto deciduas. Inflorescencias son panículas cimosas y de ramificación dicotómica, terminales o axilares, 2.5–9 cm, con 4–20 flores, pedúnculos 1–3.5 cm, ejes estrellado-puberulentos, a menudo bracteados, brácteas no observadas, pronto deciduas. Flores con pedicelos 5–12 mm, articulados, en ocasiones bracteolados, bractéolas no observadas, pronto deciduas; sépalos 5, 7–9 mm, lanceolados, estrellado-puberulentos, crema; pétalos ausentes; falanges 5, opuestos a los sépalos, cada uno con 10 estambres, parte libre de los filamentos 2–3 mm, anteras 0.75–2.5 mm, incluyendo mucro, oblongas, subiguales, mucro obsoleto o no sobrepasando a 0.12 mm; ovario con 5 leves

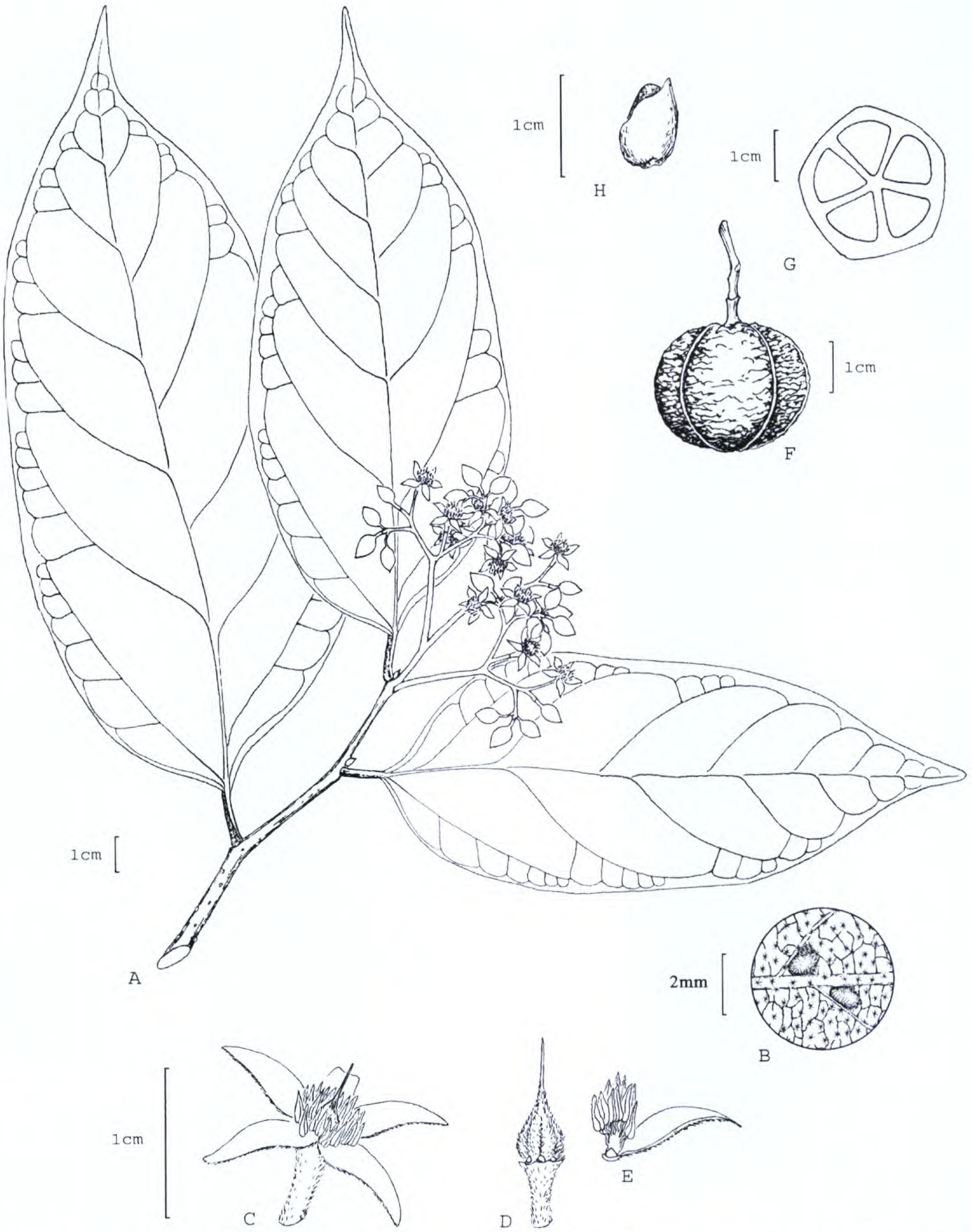

Figura 2. *Mortionodendron apetalum* Al. Rodríguez (*Haber 11161*). —A. Ramita con hojas e inflorescencia. —B. Domacios. —C. Flor. —D. Pistilo. —E. Sépalo y falange. —F. Fruto. —G. Fruto en sección transversal. —H. Semilla subtendida por el arilo.

costillas, estilo ca. 4 mm, estrellado-puberulento en la mitad basal, glabro en la mitad distal. Frutos 1.5–2.5 × 2–3 cm, globosos a ovoides, 5-locular, con 5 leves costillas, costillas formadas a lo largo del punto de unión de las valvas, valvas leñosas, pared 3–5 mm de grosor; semillas una por lóculo, fértiles o estériles, fértiles 8–10 × 7–8 mm, ovoides, envueltas completamente por el arilo.

Fenología. Flores entre marzo y abril; frutos entre julio y agosto.

Distribución. Endémica de Costa Rica, conocida en bosques húmedos de la Cordillera de Guanacaste, Cordillera de Tilarán y Cordillera Central en las vertientes Pacífica y Atlántica, entre 600–1000 m.

Mortoniodendron apetalum se reconoce por la combinación de los siguientes carácteres: hojas con glándulas pelúcidas, flores apetaladas y frutos con valvas leñosas y de pared gruesa; también, es importante mencionar como características sobresalientes que los individuos alcanzan gran tamaño, sus semillas son grandes y ovoides, cubiertas en su totalidad por el arilo, los peciolos son alargados, las hojas lanceoladas y las anteras muestran el mucro apical obsoleto a pobremente desarrollado. *Mortoniodendron apetalum* es muy relacionado a *M. ruizii* Miranda y a *M. palaciosii* Miranda, ambas especies de México, debido a que todas corresponden a grandes árboles, la lámina de sus hojas posee glándulas pelúcidas, sus flores son apetaladas, sus frutos son grandes, leñosos y de gruesas valvas. Sin embargo, se les distingue ya que estas últimas poseen flores con 4 (ocasionalmente 3) sépalos y frutos con igual número de valvas (vs. 5 sépalos y 5 valvas); además, *M. ruizii* es más pubescente en partes vegetativas, presenta peciolos más pequeños, entre 6–10 mm (vs. 9–18 mm) y pedúnculos igualmente más pequeños, entre 0.3–0.7 cm (vs. 0.1–3.5 cm). *Mortoniodendron palaciosii* tiene hojas más pequeñas, entre 7.5–14.5 × 3.5–7.2 cm (vs. 9–19 × 4.5–9 cm), base a menudo fuerte oblicua (vs. redondeada a leve oblicua) y frutos hasta 1.8 cm de ancho (vs. 3 cm).

Parátipos. COSTA RICA. **Alajuela:** Res. Biol. Monteverde, Río Peñas Blancas, *Haber 8383* (CR, INB, MO); San Ramón, cordillera de Tilarán, El Castillo, *Harmon 338* (CR, INB, MO); Upala, cordillera de Guanacaste, Parque Nac. Rincón de La Vieja, Colonia Blanca, *Rivera 1498* (CR, INB, MO). **Guanacaste:** Liberia, cordillera de Guanacaste, Est. Cacao, Sendero a Est. Maritza, *González 1111* (CR, INB, MO); Parque Nac. Rincón de La Vieja, Sendero a la toma de agua, *Rivera 599* (CR, INB, MO); Tilarán, cordillera de Tilarán, Palmital, Río Caño Negro, Quebrada Malanga, *Bello 4897* (CR, INB, MO).

3. Mortoniodendron cauliflorum Al. Rodríguez, sp. nov. TIPO: Costa Rica. Puntarenas: Península de Osa, Rancho Quemado, cerca de 15 km al Oeste de Rincón, Reserva Forestal Golfo Dulce, bosques aledaños a la carretera a lo largo del Río Riyito y cerca del puente, 8°42′N, 83°33′O, 250–350 m, 31 mayo 1988, *B. Hammel 16924* (holótipo, INB; isótipos, CR, MO). Figura 3.

Haec species a congeneris inflorescentiis caulifloris ramiflorisve atque etiam terminalibus axillaribusve distinguitur.

Arbusto o árbol pequeño de 1–8(15) m; ramitas teretes, glabras a puberulentas, con diminutos tricomas estrellados o simples. Hojas con peciolos 3–7 mm, glabros a esparcido y estrellado-puberulentos; lámina 11.5–32.5 × 3.5–10 cm, oblonga a oblongo-elíptica, coriácea, glabra sobre ambas superficies, aunque a veces con esparcidos y diminutos tricomas estrellados o simples sobre el nervio central o los secundarios, ápice largo-acuminado, base redondeada, cuneada o leve oblicua, con 5–9 pares de nervios secundarios, 3 nervios saliendo desde la base de la lámina, envés a menudo con domacios en las axilas del nervio central y en secundarios, glándulas pelúcidas ausentes; estípulas 0.2–1 mm, pronto deciduas. Inflorescencias son cortas cimas o racimos terminales, axilares, caulifloras o ramifloras, 0.8–5 cm, con 1–5 flores, ejes denso y estrellado-puberulentos, pedúnculos desde casi obsoletos hasta 1.5 cm, en la mayoría de los casos bracteados, brácteas saliendo cerca de la base y ca. 1 mm. Flores con pedicelos 5–10 mm, articulados, la mayoría bracteolados, bractéolas 0.75–1 mm; sépalos 4, 6–8 mm, elíptico-lanceolados, denso y estrellado-puberulento en el lado externo, disperso y estrellado-puberulento en la parte interna; pétalos 4, ca. de 5 mm, lanceolados, blancos, glabros; falanges 4, opuestos a los pétalos, cada uno con ca. 11 estambres, parte libre de los filamentos 1–2 mm, anteras 2.5–3.2 mm incluyendo el mucro, oblongas, desiguales, mucro ca. 0.25 mm; ovario con 5 leves costillas, estilo 4–5 mm, glabro. Frutos 1.5–2.5 × 0.8–2.5 cm, obloides, 5-locular, con 5 leves costillas, costillas formadas a lo largo del punto de unión de las valvas, valvas crustáceas, pared ca. 0.5 mm de grosor; semillas 1–2 por lóculo, fértiles a pocas veces estériles, fértiles 4–5 mm de diámetro, orbiculares, arilo subtendiendo su parte basal.

Fenología. Flores entre junio y octubre; frutos la mayor parte del año.

Distribución. Endémica de Costa Rica, se restringe a los bosques muy húmedos del Pacífico Sur, en la Península de Osa y Golfito, desde el nivel del mar hasta 600 m.

En el género, *Mortoniodendron cauliflorum* es fácil de distinguir por ser la única especie con inflorescencias caulifloras o ramifloras, aunque también terminales o axilares. Además, se reconoce por su hábito frecuentemente arbustivo, inflorescencias cortas, con pocas flores y partes vegetativas glabrescentes a diminuto puberulentas. Colecciones

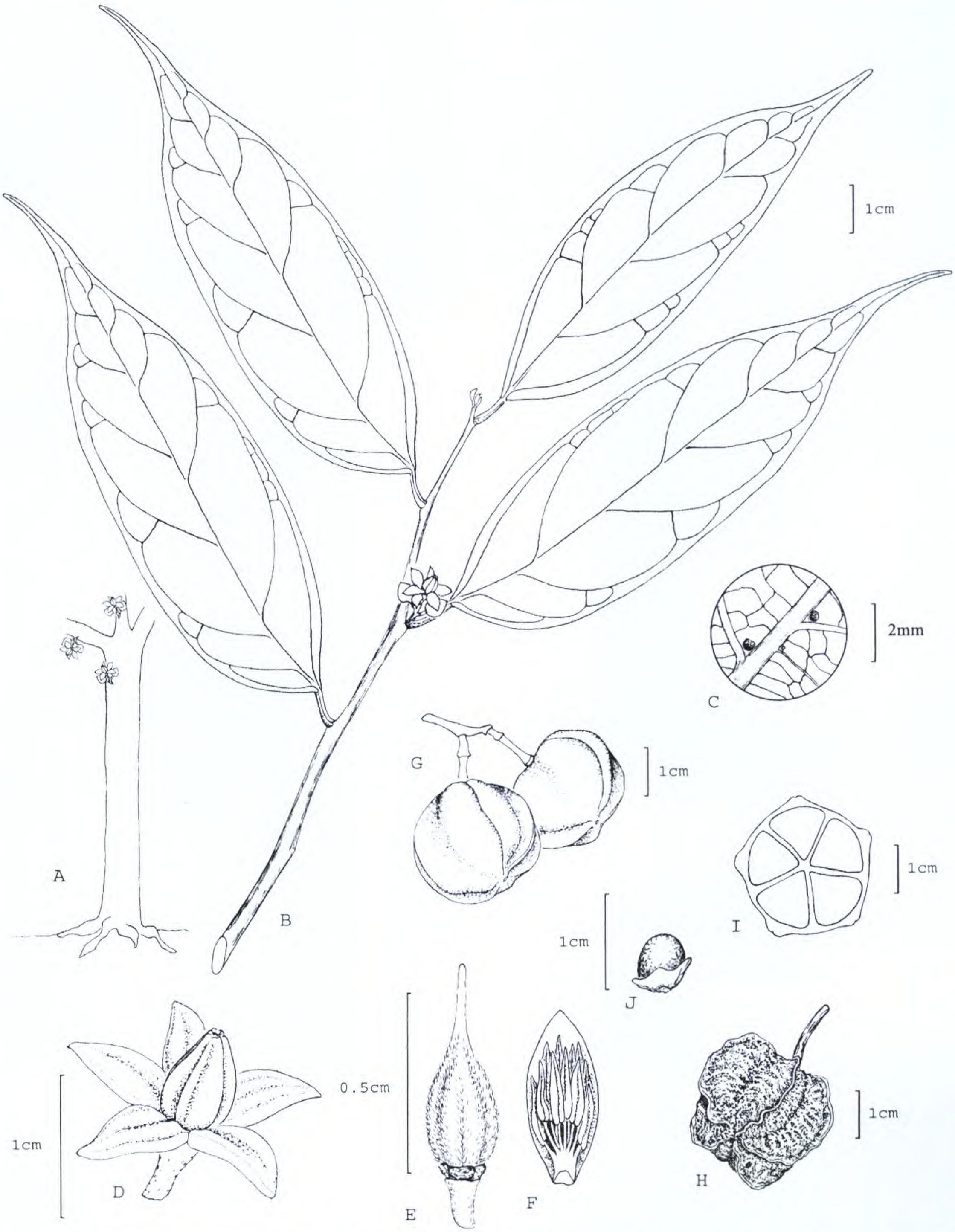

Figura 3. *Mortoniodendron cauliflorum* Al. Rodríguez (*Hammel 16924*). —A. Tronco e inflorescencias caulifloras. —B. Ramita con hojas e inflorescencia axilar. —C. Domacios. —D. Flor. —E. Pistilo. —F. Pétalo y falange. —G. Fruto fresco. —H. Fruto seco. —I. Fruto en sección transversal. —J. Semilla subtendida por el arilo. (D y G basado en fotografía, *Aguilar 7427*, INB.)

de esta especie han sido incluidas erróneamente bajo *M. anisophyllum*, especie con la cual muestra gran afinidad y es simpátrica, pero esta última se distingue debido a que tiene inflorescencias con frecuencia multifloras, hasta 20 flores (vs. hasta 5 flores), nunca son caulifloras o ramifloras, el mucro apical de las anteras es más largo, entre 0.4–0.6 mm (vs. ca. 0.25 mm), las semillas fértiles se encuentran subtendidas por el arilo hasta ¾ partes tamaño o más (vs. subtendidas basalmente) y finalmente debido a que es una especie que puede alcanzar mayor altura, hasta 20 m de altura (vs. hasta 8 m).

En los bosques muy húmedos de la Península de Osa se ha observado que *Mortoniodendron cauliflorum* es bastante común. Esta zona se ha caracterizado por el gran número de especies endémicas descritas, lo que sustenta el valor biológico de esta región e invita a la preservación de sus hábitats naturales. Aparte de Golfito y Península de Osa, probablemente esta especie se encuentra en otras áreas de la vertiente Pacífica de Costa Rica, e inclusive de Panamá.

Parátipos. COSTA RICA. **Puntarenas:** Golfito, Refugio Natural de Vida Silvestre Golfito, Fila Gamba, *Lépiz 525* (CR, INB); Osa, Parque Nac. Corcovado, Cerro Brujo, *Herrera 3976* (CR, INB, MO); Est. Sirena, *Aguilar 2404* (CR, INB, MO); Los Planes, *González 51* (INB, MO); Sendero Mirador, *Angulo 484* (CR, INB, MO); Sendero Río Claro, *Kernan 877* (MO); Res. For. Golfo Dulce, Agua Buena, *Aguilar 617* (MO); Est. Agujas, *Azofeifa 214* (INB); Est. Biol. Marenco, *Burger et al. 12355* (NY); Los Mogos, *Aguilar 2946* (CR, INB, MO); Puerto Piro, *González 436* (CR, INB, MO); Quebrada Huaca, *Dodge & Goerger 10309* (MO); Rancho Quemado, *Hammel 18299* (CR, INB, MO); Rincón, *Rodríguez 2444* (CR, INB, MO); Sierpe, *Morales 31* (INB).

4. Mortionodendron longipedunculatum Al. Rodríguez, sp. nov. TIPO: Costa Rica. Limón: Talamanca, Amubri, margen izquierdo del río Urén, Loma Sheuab, 9°32.5′N, 82°54′O, 150 m, 25 jun. 1989, *G. Herrera 2992* (holótipo, CR; isótipos, MO, USJ). Figura 4.

Haec species inter congeneros inflorescentia pedunculo notabiliter elongato insidente atque foliorum nervis basalibus vix manifestis perfacile recognoscitur.

Arbusto o árbol pequeño de 3–4 m; ramitas teretes, glabras. Hojas con peciolos 1.5–5 mm, estrellado-puberulentos; lámina 9.5–13 × 3–3.8 cm, elíptica, coriácea, haz y envés glabros o con diminutos y esparcidos tricomas estrellados, ápice acuminado, base conspicuo oblicua, con 6–8 pares de nervios secundarios, 3–5 nervios ligeramente visibles saliendo desde la base de la lámina, envés a menudo con domacios en las axilas del nervio central y en secundarios, glándulas pelúcidas ausentes; estípulas no observadas, pronto deciduas. Inflorescencias son panículas cimosas, terminales, 4–10.5 cm, 5–10-flores, ejes glabros a esparcido puberulentos, pedúnculos 3.5–8.5 cm, brácteas no observadas, pronto deciduas. Flores con pedicelos 5–10 mm, articulados, bracteolas no observadas, pronto deciduas; sépalos 5, ca. 7 mm, elípticos, denso estrellado-puberulentos en el lado externo, corto tomentoso a puberulentos en la parte interna; pétalos 5, 4–5 mm, lanceolados, con la base blanca y el ápice amarillo, glabros; falanges 5, opuestos a los pétalos, cada uno con ca. 7 estambres, parte libre de los filamentos 1–1.5 mm, anteras 1.5–1.75 mm, incluyendo el mucro, oblongas, subiguales, mucro ca. 0.3 mm; ovario con 5 leves costillas, estilo ca. 2 mm, glabro. Frutos ca. 1.5 × 1.5 cm, obloides, 5-locular, con 5 leves costillas, costillas formadas a lo largo del punto de unión de las valvas, valvas crustáceas, pared ca. 0.25 mm de grosor; semillas 2 por lóculo, fértiles o estériles, fértiles 5–6 mm de diámetro, orbiculares, cubiertas totalmente por el arilo.

Fenología. Flores en junio; frutos en julio.

Distribución. Endémica de Costa Rica, restringida a los bosques muy húmedos de la vertiente Atlántica, región de Suretka y Amubri en Talamanca, entre 150–250 m.

Mortoniodendron longipedunculatum se reconoce de las otras especies del género por presentar inflorescencias con pedúnculos muy alargados. Además, se distingue por su pequeño hábito, ramitas y hojas glabrescente, lámina angosta, con la base conspicuo oblicua, nervios basales poco visibles y por sus semillas cubiertas en su totalidad por el arilo. Esta especie presenta similitud con *M. cauliflorum* y *M. anisophyllum* debido a sus frutos pequeños, con valvas crustáceas y delgadas. Sin embargo, ambas especies se separan debido a que podrían mostrar inflorescencias con pedúnculos más cortos (nunca más de 1.5 cm), hojas con la base redondeada, cuneada a leve oblicua, nervios basales conspicuos y flores con mayor número de estambres por falange (10–11 estambres).

Parátipo. COSTA RICA. **Limón:** Talamanca, Suretka, bosques cercanos al sitio de exploración petrolera, *Laurito 9531* (CR, USJ).

5. Mortoniodendron moralesii Al. Rodríguez, sp. nov. TIPO: Costa Rica. San José: Acosta, Fila Bustamante, Hacienda Tiquires, bosque primario y secundario en el camino a Aguas Buenas, 9°43′10″N, 84°10′50″O, 1600–1800 m, 3 jun. 1995, *F. Morales 4280* (holótipo, INB; isótipos, BM, CR, F, K, MEXU, MO, NY, UC, US, W). Figura 5.

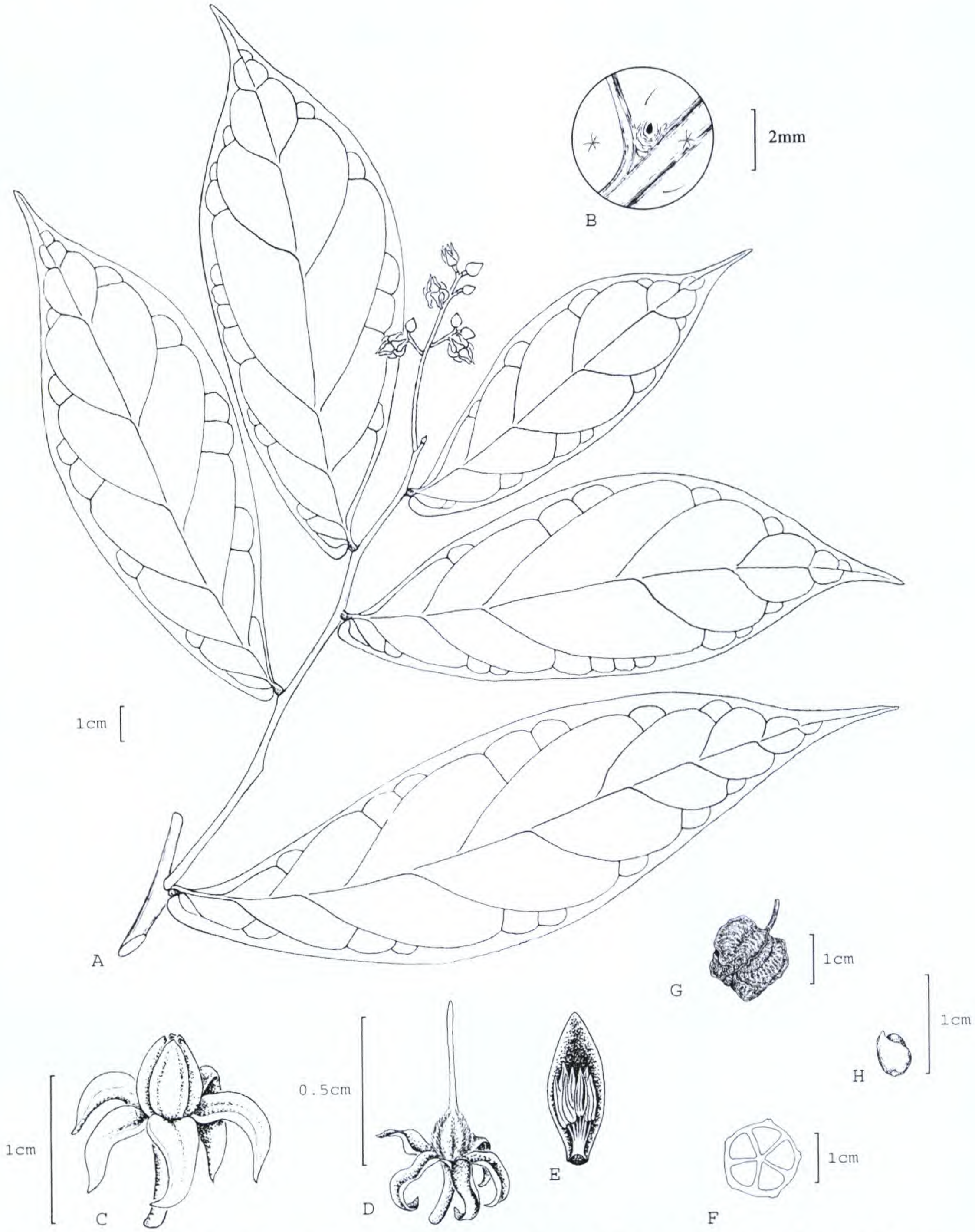

Figura 4. *Mortoniodendron longipedunculatum* Al. Rodríguez (*Herrera 2992*). —A. Ramita con hojas e inflorescencia. —B. Domacio. - C. Flor. —D. Pistilo y sépalos (pétalos caedizos). —E. Pétalo y falange. —F. Fruto en sección transversal. —G. Fruto. —H. Semilla subtendida por el arilo.

Haec species inter congeneros fructus ellipsoidei grandis ecostati vel leviter costati loculis 3- ad 6-seminalibus et valvarum parietibus percrassis induratis recognoscitur.

Árbol de 6–15 m; ramitas teretes, estrellado-tomentosas en partes terminales. Hojas con peciolos entre 8–14 mm, estrellado-tomentosos; lámina 7–14 × 3.5–6.5 cm, elíptica a obovada-elíptica, coriácea, haz glabrado a estrellado-puberulento sobre los nervios, envés densamente estrellado-puberulento, ápice corto acuminado, base leve asimétrica,

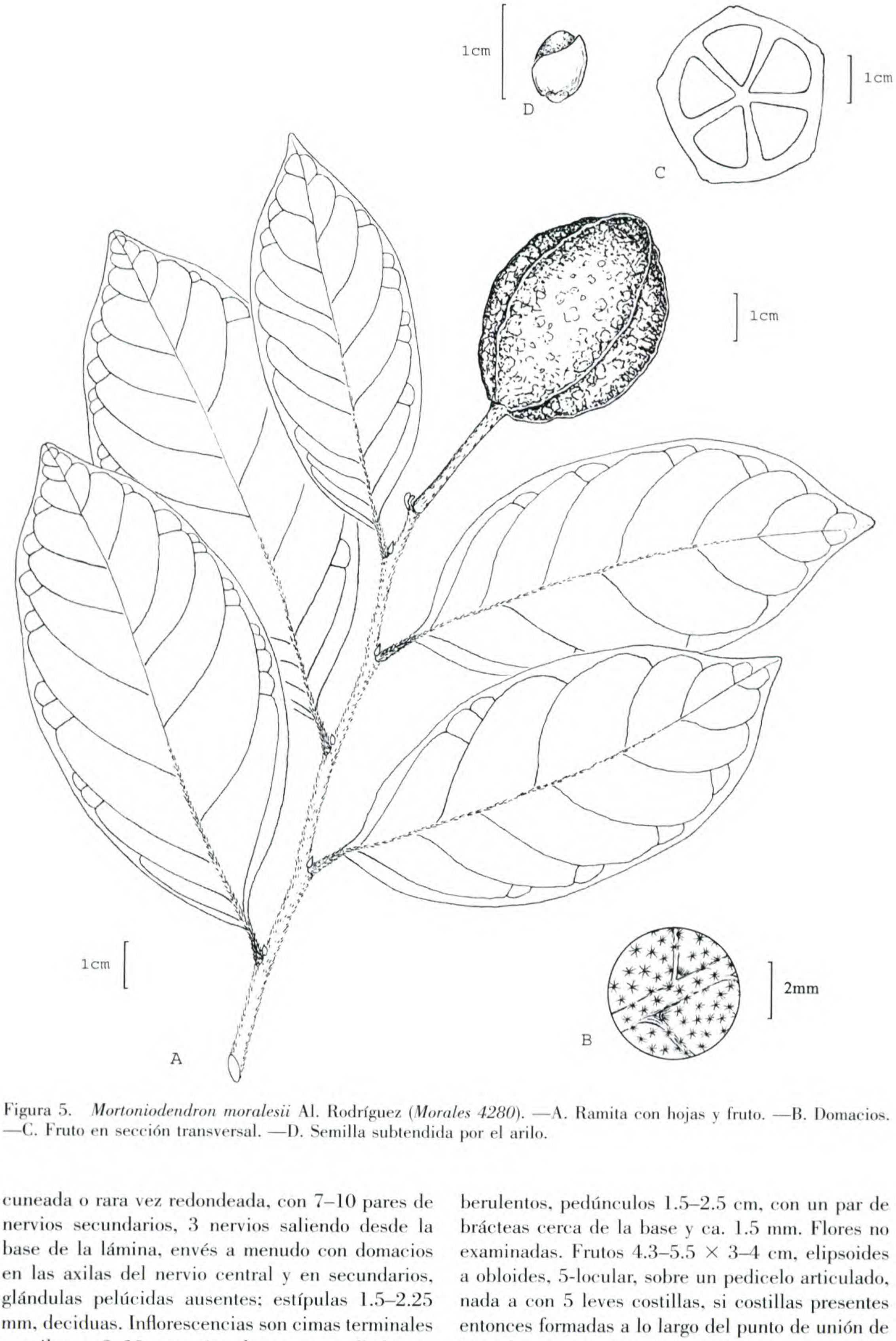

Figura 5. *Mortoniodendron moralesii* Al. Rodríguez (*Morales 4280*). —A. Ramita con hojas y fruto. —B. Domacios. —C. Fruto en sección transversal. —D. Semilla subtendida por el arilo.

cuneada o rara vez redondeada, con 7–10 pares de nervios secundarios, 3 nervios saliendo desde la base de la lámina, envés a menudo con domacios en las axilas del nervio central y en secundarios, glándulas pelúcidas ausentes; estípulas 1.5–2.25 mm, deciduas. Inflorescencias son cimas terminales o axilares, 3–10 cm, ejes denso y estrellado-puberulentos, pedúnculos 1.5–2.5 cm, con un par de brácteas cerca de la base y ca. 1.5 mm. Flores no examinadas. Frutos 4.3–5.5 × 3–4 cm, elipsoides a obloides, 5-locular, sobre un pedicelo articulado, nada a con 5 leves costillas, si costillas presentes entonces formadas a lo largo del punto de unión de las valvas, valvas leñosas, pared 5–7 mm de grosor

(hasta 10 mm en la parte apical); semillas 3–6 por lóculo, fértiles a menos frecuente estériles, fértiles ca. 9 × 6 mm, orbiculares, arilo cubriendo ¾ de su tamaño.

Fenología. Frutos en abril, junio y agosto.

Distribución. Endémica de Costa Rica, conocida en los bosques húmedos de la faja costeña del Pacífico Central (Tiquires, Fila Aguabuena, Acosta) y en la vertiente Atlántica (Lago Dabagri), entre 1300–1850 m.

Mortoniodendron moralesii se reconoce fácilmente por sus grandes frutos elipsodes a obloides, nada o leve acostillados, paredes valvares muy gruesas y endurecidas y finalmente por sus lóculos con 3 a 6 semillas. Además, esta especie presenta el envés de las hojas, ramitas y ejes de las inflorescencias densamente estrellado-puberulentos o estrellado-tomentosos. El material colectado en la vertiente Atlántica (*Gómez 23138*) muestra leves diferencias con respecto al colectado en el Pacífico Central ya que sus tallitos y hojas son menos pubescentes y sus frutos aparentemente menos elipsoides, por lo que es importante tener en consideración estas diferencias y analizarlas mejor en presencia de más material. Aunque esta especie no ha sido observada con flores, sus grandes frutos con valvas leñosas y gruesas la hacen distintiva. En el género, otras especies que comparten caracteres similares en los frutos son *M. abelianum, M. apetalum* y *M. pentagonum. Mortoniodendron abelianum* se distingue por sus frutos conspicuamente más acostillados, semillas más pequeñas, ca. 5 mm (vs. ca. 9 × 6 mm), tallitos estrellado-puberulentos (vs. estrellado-tomentosos) y ápice de las hojas levemente más largos. *Mortoniodendron apetalum* se separa con facilidad debido a que tiene hojas con glándulas pelúcidas (vs. carente de glándulas) y frutos con una semilla por lóculo (vs. 3–6 semillas), las cuales se encuentran envueltas completamente por el arilo (vs. cubiertas ¾ partes de su tamaño). *Mortoniodendron pentagonum* es diferente debido a que presenta hojas plinervadas, las cuales carecen de domacios, sus láminas foliares tienen glándulas pelúcidas, los pedicelos no son articulados y finalmente debido a que los lóculos de los frutos tienen únicamente una semilla, la cual está cubierta totalmente por el arilo. También, vegetativamente podría ser confundido con *M. anisophyllum;* sin embargo, esta última presenta tallitos y hojas glabrescentes a estrellado-puberulentos, los frutos son más pequeños (entre 1–2 × 1–2 cm), la pared del exocarpo es más delgada (hasta 0.5 mm) y su rango de distribución es distinto (1–850 m).

El epiteto está dedicado al botánico Francisco Morales (INB), quien ha realizado excelentes colecciones de esta especie y por sus grandes aportes a la flora costarricense.

Parátipos. COSTA RICA. **Limón:** Borde del Lago Dabagri, *Gómez 23138* (CR, NY). **San José:** León Cortés, Cerros de Caraigres, Fila El Alto, *Morales 6244* (CR, INB, MO); Puriscal, Cuenca del Tulín, Mercedes Sur, *Vargas 340* (CR, INB); San Martín, Cerros de Puriscal, Faldas del Cerro Bola, *Morales 5715* (CR, INB, MO).

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Laennecia araneosa (Compositae: Astereae), a New Combination for the West Indies

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ABSTRACT. The new combination *Laennecia araneosa* (Compositae: Astereae) is validated, and this species is placed in section *Laennecia*. *Laennecia* is newly documented in the West Indies.

Key words: Asteraceae, Astereae, Caribbean, Compositae, *Conyza*, Dominican Republic, *Erigeron*, Hispaniola, *Laennecia*, West Indies.

In conjunction with floristic study of Compositae tribe Astereae in Argentina (Sancho & Ariza Espinar, 2003) and for *Flora Mesoamericana*, we had the occasion to study material of *Conyza araneosa* (Urban) Cronquist, endemic to the Dominican Republic on the island of Hispaniola in the West Indies. Morphological and anatomical features show that this taxon belongs to *Laennecia* Cassini. Here, we provide the needed combination for this species, increasing to 19 (see Nesom, 2000, 2001) the number of species recognized in *Laennecia*.

Cronquist (1943) reinstated *Conyza* Lessing from synonymy within *Erigeron* L. As delineated by Cronquist (1943), *Conyza* contained the earlier *Laennecia*, over which it is conserved. *Conyza* and *Laennecia* are similar by lacking obviously radiate capitula, having instead disciform to subradiate capitula (all corollas being about as long as the pappus) with several series of marginal pistillate florets and fewer disk florets than marginal ones. *Conyza* (and *Laennecia*) differs from *Erigeron* in each of these features, as noted by Cronquist (1943).

Cuatrecasas recognized *Conyza* sect. *Laennecia* (Cassini) Cuatrecasas (informally in 1963, and formally in 1969), whereas Zardini (1981) reestablished *Laennecia* at the generic rank. Cuatrecasas (1969) and Zardini (1981) each circumscribed *Laennecia* as including solely two principally South American species [*L. filaginoides* DC. and *L. gnaphalioides* (HBK) Cassini]. They circumscribed *Laennecia* as having double (vs. a single) series of subequal pappus bristles, the outer series of which is of short bristles or short scales. Cuatrecasas (1969) and Zardini (1981) further distinguished *Laennecia* from *Conyza* s. str. by densely pubescent (vs. sparsely pubescent) cypselae and by lanate (vs. usually not lanate) vestiture.

Nesom (1990) expanded *Laennecia* by describing a second section and by including 13 more species, these similar in habitat (e.g., tropical and subtropical montane habitats) and generally similar in vestiture to the two species recognized by Cuatrecasas (1969) and Zardini (1981). Among the recently transferred or new species recognized by Nesom (1990, 2000, 2001), only seven have a double pappus, albeit this feature was regarded by Cuatrecasas (1963, 1969) and Zardini (1981) as defining *Laennecia*. Additionally, the four species placed by Nesom in *Laennecia* sect. *Sophiifolia* Nesom (as "*Sophiifolium*" in Nesom, 1990) have hirsute-pilose (not arachnoid-lanate) leaf vestiture, thereby differing from species of the nominate section. Nesom's (1990) broader concept of *Laennecia* stressed that it differed from *Conyza* by phyllaries centrally greenish (vs. not green) with a single (vs. 3) vein, by disk corolla veins lightly colored (vs. orange) with lobes about as long as (vs. much shorter than) the throat, and by usually glandular (vs. eglandular) cypselae.

While studying *Conyza araneosa*, we noted that it has arachnoid-lanate vestiture, disk corollas lightly veined with lanceolate lobes about as long as the throat, and strigose, generally conspicuously apically glandular cypselae (see Fig. 1). These characters are congruent with those of an expanded *Laennecia*. Moreover, in the protologue of *Erigeron araneosus*, Urban (1902–1903) related it to *E. niveus* Schultz Bipontinus (a synonym of *L. gnaphalioides*, the generitype), which independently supports our relocation of *C. araneosa* to *Laennecia*. In

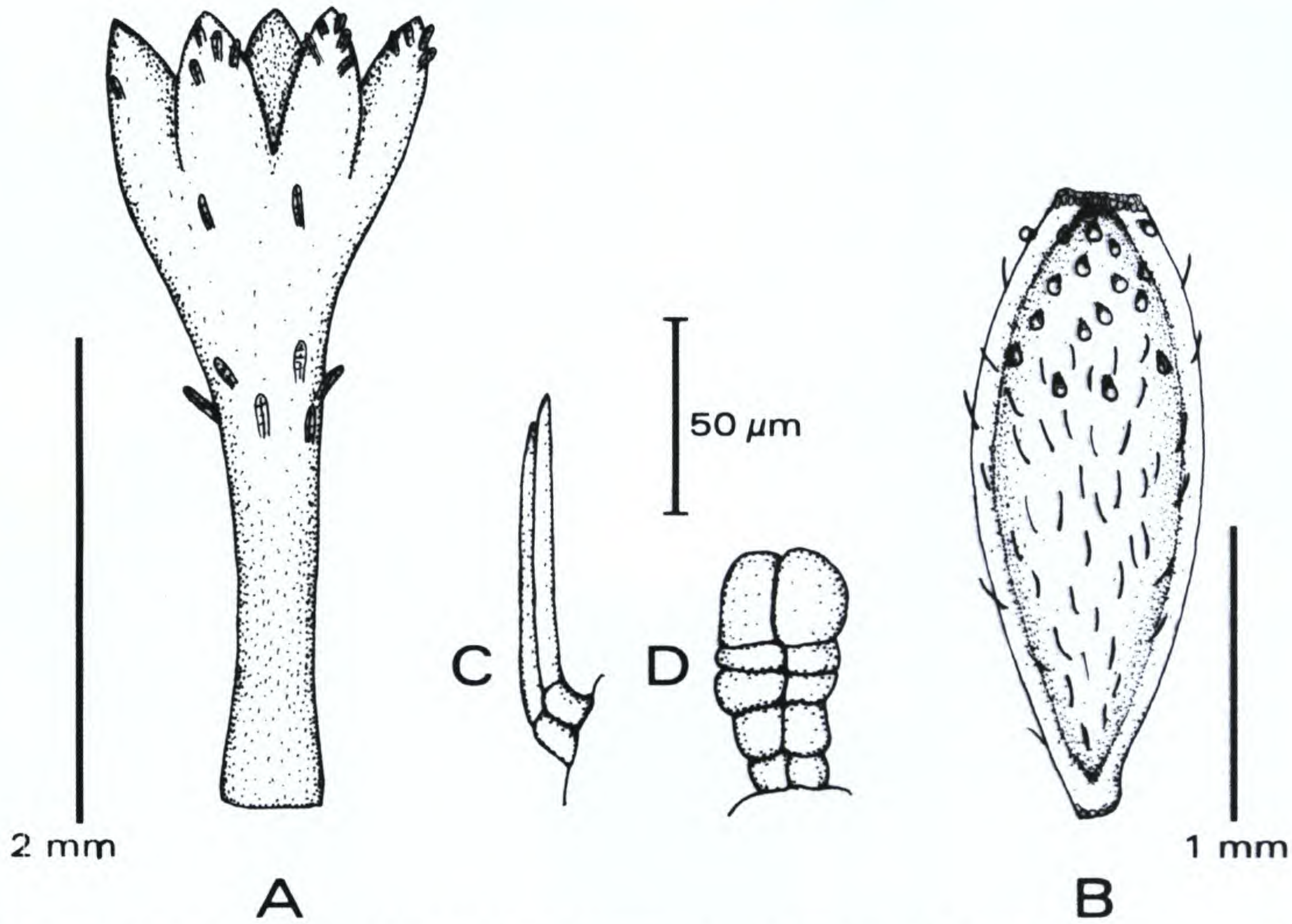

Figure 1. *Laennecia araneosa* (Urban) G. Sancho & Pruski. —A. Disk corolla. —B. Cypsela with pappus removed. —C. Twin hair of cypsela. —D. Glandular trichome of cypsela. (Drawn by Gisela Sancho from *Ekman 13566*, US.)

addition to making the following needed combination, we provide a description of *L. araneosa* including the diagnostic generic features of *Laennecia* lacking in the protologue of *E. araneosa* Urban, yet stressed by Nesom (1990).

No West Indian species of *Conyza* now referable to *Laennecia* (other than *L. araneosa*) were listed by Adams (1972), Correll and Correll (1982), Grisebach (1864), Howard (1989), Liogier (1962, 1996, 1997), Nesom (2000), Proctor (1984), or Urban (1921), nor are any Virgin Islands species referable to *Laennecia*. Thus, the transfer to *Laennecia* of this species from the Dominican Republic marks the first report of the genus *Laennecia* in the West Indies. The 18 other species of *Laennecia* occur on Continental America between the southwestern United States and northern Argentina (Nesom, 1990; Sancho & Ariza Espinar, 2003), and 5 of these mainland species are treated in the *Laennecia* treatment in *Flora Mesoamericana* (Sancho & Pruski, in prep.).

Laennecia araneosa (Urban) G. Sancho & Pruski, comb. nov. Basionym: *Erigeron araneosus* Urban, Symb. Antill. 3: 404. 1903. *Conyza araneosa* (Urban) Cronquist, Bull. Torrey Bot. Club 70: 632. 1943. TYPE: Dominican Republic. La Vega: Valle Nuevo, 2270 m, May sin. annum, *Eggers 2200* (holotype, B, destroyed, photograph (taken by Harvey M. Hall in 1925) at UC not seen, US). Figure 1. Although we were unable to locate isotype material (in C, MO, NY, O, UC, US), we are optimistic that isotype material exists in other herbaria, from which a future lectotype sheet may be designated.

Low annual or short-lived perennial, tap-rooted herbs, 8–49 cm tall, few- to several-branched from near the base, herbage glandular, arachnoid-lanate, trichomes glandular and non-glandular; stems ascending, subterete, internodes commonly slightly shorter than leaves. *Leaves* alternate, sessile, moderately pinnately lobed, (5)7–15 mm long, 1–4 mm wide, oblanceolate, chartaceous, base slightly clasping, margins flat, marginal lobes 2 to 4, elliptic-ovate, ca. 1–1.5 × ca. 0.5 mm, apex of blade and lobes acute to rounded, sometimes slightly mucronulate. *Capitulescence* axillary from the uppermost nodes, racemose; peduncles 0.3–1.2 cm long.

Capitula heterogamous, subradiate, 50- to 70-flowered; involucre campanulate, 3–4(4.5) mm high, 3–4.5 mm wide; phyllaries 2(3)-seriate, linear-lanceolate, 2–4(–4.5) mm long, ca. 0.7 mm wide, glandular, basally tan, midrib region greenish, margins hyaline, apex acuminate, often lacerate or ciliate. *Marginal florets* pistillate, 45 to 61, pluriseriate, corollas subradiate, filiform, 2.5–3 mm long, cream-colored, tube weakly glandular, limb distinct, short, 0.2–0.5 mm long, apex bi- or tridentate, style often exserted to apex of limb; *central disk florets* bisexual, 5 to 9, corolla funnelform, 2.5–3 mm long, cream-colored, glandular at the apex of the tube and lobes, tube ca. 1.5 mm long, throat 0.6–0.8 mm long, lobes 5, lanceolate, 0.4–0.7 mm long, anther thecae ca. 0.5 mm long, style branches ca. 0.5 mm long, apex triangular-lanceolate. *Cypselae* compressed, elliptic-obovate, 1.2–1.4 mm long, apically constricted, moderately 2-nerved marginally, strigose, generally resinous glandular distally, glands often deciduous rather than persistent; pappus uniseriate, of 15 to 25 scabrid stramineous bristles, usually 2.5–3 mm long.

Distribution and ecology. *Laennecia araneosa* is endemic to the Dominican Republic. This species is locally common in grassy pinelands of the Cordillera Central in the south-central part of the island at elevations between 2000 and 2300 m. Most collections are from near Valle Nuevo, at approximately 18°48′N, 70°42′W. Plants seemingly flower year round, having been collected in January, April, May, August, and September. The genus should be looked for in mountainous regions elsewhere in the West Indies, especially on the biogeographically similar Cuba.

We place *Laennecia araneosa* in section *Laennecia* because of its arachnoid-lanate vestiture, pinnately lobed leaves, marginal corollas with short ligules, and cypselae generally with large resinous glands. Within section *Laennecia*, *L. araneosa* seems, by clasping leaves, glandular leaves and phyllaries, ligulate marginal corollas, and few (15 to 25) pappus bristles, to be most closely related to *L. microglossa* and *L. schiediana*.

Additional material examined. DOMINICAN REPUBLIC. **Azua:** Cordillera Central, San Juan, Lomas de la Medianía, near Sabana Nueva, *Ekman 13566* (NY, US). **La Vega:** Valle Nuevo, *Bueno 1753* (US), *Jiménez & Lithgow 1385* (US), *Liogier 12207* (NY, US); prope Constanza infra Valle Nuevo, *von Türckheim 3160* (MO, NY, US).

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Ballota byblensis (Lamiaceae), a New Species from Lebanon

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ABSTRACT. A new species of the genus *Ballota* L. (Lamiaceae) is described from the western slopes of Mount Lebanon in an eastern Mediterranean climate. *Ballota byblensis* Semaan & R. M. Haber is distinguished by the following characters: perennial herb, suffrutescent, brittle; stem densely matted with patent tiny simple to long septate glandular trichomes, with few sessile glands; cauline leaves cordate, crenate, rugose, tomentose with glandular simple-stellate trichomes on both sides; inflorescence lax; verticillaster 6- to 19(22)-flowered; bracteoles many, filiform, glandular, shorter than calyx; calyx 9–10 mm long, infundibular, with glandular simple-stellate trichomes outside, appressed pilose-pubescent in the upper half inside; limb erecto-patent, oblique; teeth 10(11), unequal; corolla 16–18 mm long, pink-purple; seeds black.

Key words: *Ballota*, endemic, Lamiaceae, Lebanon, Mediterranean.

The genus *Ballota* (Lamiaceae) comprises five species in Lebanon (Mouterde, 1983; Greuter et al., 1986; Heller & Heyn, 1986). *Ballota antilibanotica* Post, *B. undulata* (Sieber ex Fresenius) Bentham, and *B. damascena* Boissier are basically restricted to the Levant and Sinai occurring in sub-arid to arid regions. *Ballota nigra* L. subsp. *uncinata* (Fiori & Béguinot) Patzak and *B. saxatilis* Sieber ex J. & C. Presl attain wider geographical distribution surviving under more temperate conditions (Davis & Doroszenko, 1975).

Ballota byblensis Semaan & R. M. Haber, sp. nov. TYPE. Lebanon. Jbeil Province: Jaj Mountain, 1600 m, 34°09′22.8″N, 35°50′10.2″E, 10 Aug. 2002, *R. Haber & M. Semaan 2002* (holotype, MO; isotypes, BEI, K). Figure 1.

Herba perennis, suffrutescens, fragilis; caulis dense implicitus cum patentibus minutis longis septatis glandiferis pilis et paucis sessilibus glandibus; folia caulina cordata, crenata, rugosa, pilis stellatis glandiferis in superficiebus ambabus folii; inflorescentiae laxae; verticillastri 6–19(22) floribus; bracteolae plurimae, 2.0–6.0 × 0.2–0.5(0.7) mm, filiformes, glandiferae; calyx 9–10 mm, infundibularis, extra glandifer, stellatis pilis, intra pubescens in dimidio superiore; limbus erecto-patens, obliquus; dentes 10(11) inaequales; corolla 16–18 mm, rosea-purpurata.

Perennial herb, suffrutescent, rhizomatous, fragrant, brittle woody and green parts; flowering stems up to 35 cm long, less than 2 mm wide, quadrangular, branched or simple, brown at base, green above, densely matted with patent tiny simple to long septate glandular trichomes, and with few sessile glands, vegetative stems 5–7 cm long. Cauline leaves petiolate, petiole 2.0–2.5(3.0) cm long, blade (2.0)2.5–3.3 × 2.5–3.3 cm, orbicular to broadly oval, cordate, deeply crenate, rugose, tomentose with stellate glandular trichomes above, tiny simple to long septate glandular trichomes and sessile glands below, green above, grayish green below with denser indumentum; floral leaves petiolate, petiole 3–20 mm long, blade 1.0–2.5 × 1.0–2.5 cm, orbicular-oval, truncate-cordate, indumentum similar to cauline leaves. Inflorescence lax; verticillaster 6- to 19(22)-flowered, pedicellate; pedicels 2–3 mm long, with dense patent tiny simple to long septate glandular trichomes; bracteoles many, 2.0–6.0 × 0.2–0.5(0.7) mm, filiform, sometimes with 1 or 2 teeth, mucronate, with patent tiny simple to long septate glandular trichomes, denser on outside and occasionally with stellate trichomes. Flower 19–20 mm long, sessile; calyx 9–10 mm long, infundibular; tube 7.5 mm long and terminating in a circular vein, with dense patent tiny simple to long septate glandular trichomes outside, and stellate glandular trichomes in the upper third, glabrous in the lower half inside and appressed pilose-pubescent in the upper half; limb 6–7 mm diam., erecto-patent, oblique (Fig. 2); teeth 10(11), unequal, 1.0–2.5 × 0.7–1.4 mm including mucro of 0.2–0.5 mm, triangular-oval, pubescent inside, with glandular stellate, tiny simple and long septate trichomes outside; corolla 16–18 mm long; tube 9–

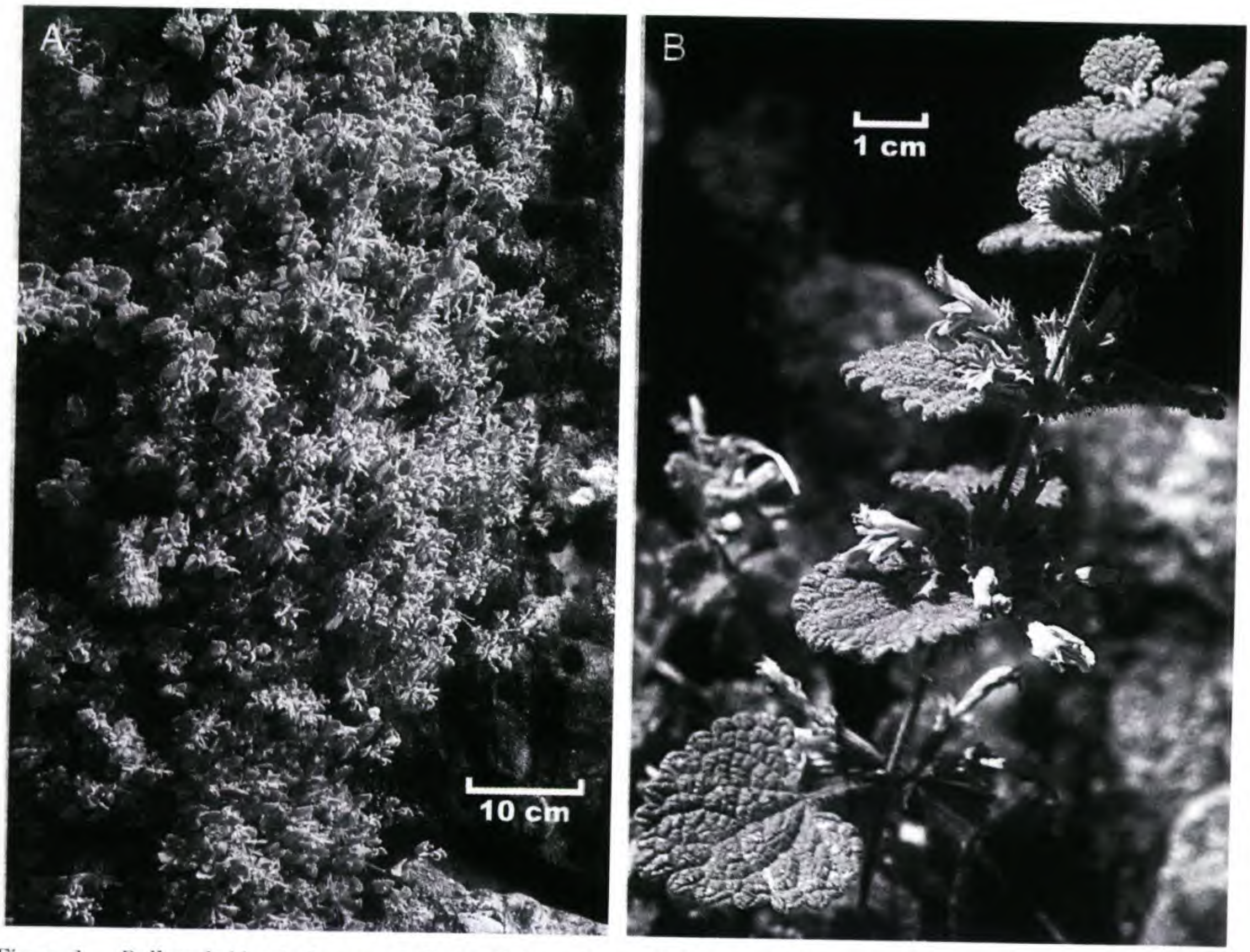

Figure 1. *Ballota byblensis* Semaan & R. M. Haber, photos of holotype collection taken by authors in Jaj Mountain. —A (left). Whole plant. —B (right). Inflorescence.

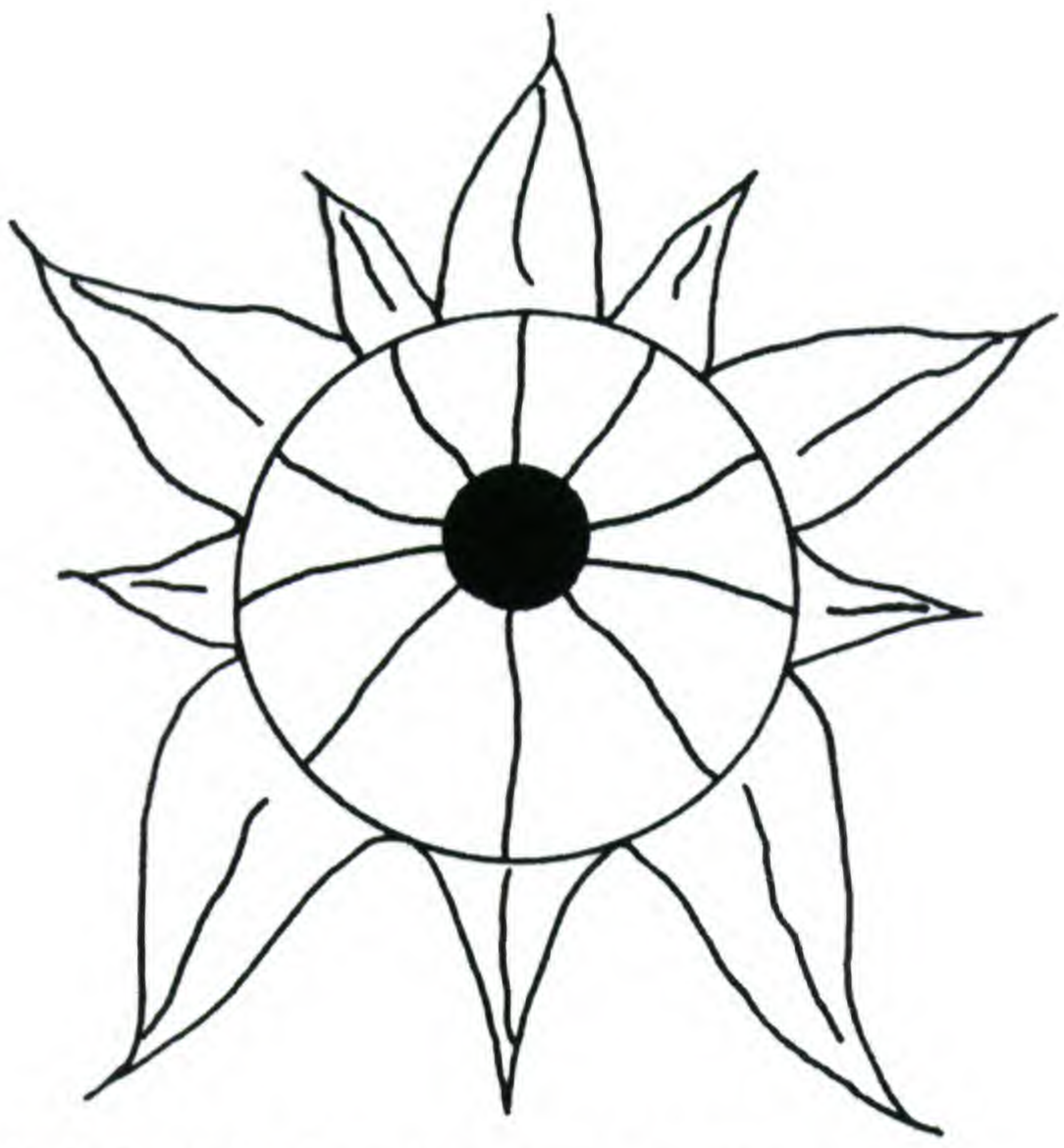

Figure 2. Illustration of calyx limb drawn by the authors from the holotype specimen.

11 mm long, white, well exserted, with sessile glands and downward appressed long trichomes outside, and annulus of trichomes inside; upper lip 6.0–7.5 × 3.5 mm, white outside, pink inside, bifid with lobes divided and/or gnawed, appressed villous outside at base and margins, with dense stellate glandular trichomes at center especially on hood, bearded inside at hood and lobes, glabrous below; lower lip 6.0–6.5 mm long, purple striated with white, glabrescent below; filaments variegated white and pink-purple, with papillae below, lanate above; style 14 mm long, white bifid. Seeds 2.6–2.8 × 1.2–1.3 mm, oblong-obovate, black, tip truncate, with sessile white glands gradually disappearing with maturity.

Distribution and habitat. *Ballota byblensis* is localized and confined to the rugged high Jaj Mountain of Jbeil Province on the western slopes of the Mount Lebanon Range at 1600–1800 m in altitude. The habitat is marked with a harsh winter of low temperature, stormy winds, frost, and a considerable snow cover. The summer is moderate and humid (Service Météorologique, 1966, 1967). The region lost its conifer forests over time, reducing the terrain to strongly eroded masses of rocks with pockets of soil (Beals, 1965). The occurrence of *B. byblensis* is relatively common. It hangs out of crevices in sandy limestone rocks with woody branches extending over rock faces. Grazing is intensive in the region and strongly impacts the green cover. Though *B. byblensis* seems not consumed by ruminants, its brittle nature exacerbates the impact of trampling and similar abrasive activity. The flowering period of *B. byblensis* extends from August to early September, as observed by the authors.

Ballota byblensis is closest morphologically to *B. saxatilis* and *B. antilibanotica* of the Lebanese flora. The differentiation of *B. byblensis* from other *Ballota* species in Lebanon is elucidated in the following key (Post, 1932; Davis & Doroszenko, 1975; Feinbrun-Dothan, 1978; Mouterde, 1983).

1a. Calyx limb short with shallow crenation or dentation.
  2a. Calyx limb multicrenate to multidentate, broadly expanded; stem hirsute . . *B. undulata*
  2b. Calyx limb with 10 to 12(20) spinulate crenae; stem white floccose-lanate . . . . . *B. damascena*
1b. Calyx limb with triangular-ovate teeth.
  3a. Calyx teeth 5; bracteoles subulate . . . *B. nigra* subsp. *uncinata*
  3b. Calyx teeth at least 10; bracteoles linear-filiform.
    4a. Stem with short stellate appressed pubescence and longer simple to branched-stellate glandular trichomes; leaves round-reniform; bracteoles as long as calyx . . . . . *B. antilibanotica*
    4b. Stem not as above; leaves orbicular-ovate; bracteoles shorter than calyx.
      5a. Stem matted with simple and long septate glandular trichomes; verticillasters lax; bracteoles mucronate; corolla 16–18 mm . . . . . *B. byblensis*
      5b. Stem eglandular-villous of shortly fasciculate or stellate trichomes, with or without simple trichomes; verticillasters dense; bracteoles emucronate; corolla 10–16 mm . . . . . *B. saxatilis*

In addition, *Ballota byblensis* differs from *B. saxatilis* by its longer bracteoles with glandular and only occasionally stellate trichomes, and glandular trichomes on the calyx. *Ballota byblensis* differs further from *B. antilibanotica* by having a well-exserted corolla tube and a darker pink-purple corolla. The two species are allopatric with considerable disparity in habitat characteristics: *B. antilibanotica* is an inland species of semi-arid regions, whereas *B. byblensis* is a montane species. Among the flora of Turkey, *B. byblensis* shares morphological characters with the two endemic species *B. latibracteolata* P. H. Davis & Doroszenko and *B. larendana* Boissier & Heldreich, which are close to *B. saxatilis*. *Ballota byblensis* differs from *B. latibracteolata* by having both sides of leaves glandular, non-ciliate filiform bracteoles, infundibular calyx, erecto-patent limb, pink-purple corolla with white stripes, not white corolla with purple stripes. *Ballota byblensis* differs from *B. larendana* by its brittle nature, by glandular leaves, bracteoles shorter than calyx, glandular infundibular calyx, erecto-patent limb, and longer corolla. *Ballota byblensis* is also distinguished morphologically from the central Mediterranean *B. rupestris* (Bivona-Bernardi) Visiani and the southwest European and northwest African *B. hirsuta* Bentham (Tutin et al., 1972). *Ballota byblensis* differs from *B. rupestris* by smaller and ovate-orbicular cauline leaves, non-membranous bracteoles, larger diameter of limbs, and longer corolla. It also differs from *B. hirsuta* by its smaller calyx and limb diameter, and longer corolla.

Ballota byblensis is named after the Neolithic Canaanite city, Jbeil (Byblos), as it was discovered on the overlooking Jaj Mountain slopes from which the Phoenicians felled cedars to trade wood with the ancient world (Meiggs, 1982).

Paratype. LEBANON. **Jbeil Province:** Jaj Mountain, 1697 m, 24 Aug. 2002, *R. Haber & M. Semaan 2002* (BEI, MO, K).

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Rubiacearum Americanarum Magna Hama Pars XVI. New Species, a New Subspecies, and an Overlooked Species of *Psychotria* subg. *Heteropsychotria* from Mexico, Central America, and Western South America

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ABSTRACT. Described and illustrated are the new species: *Psychotria calidicola* C. M. Taylor, found in Costa Rica and Panama and previously confused with *P. eurycarpa* Standley; *P. chocoana* C. M. Taylor, found in northwestern Colombia; *P. gaitalensis* C. M. Taylor of central Panama, previously confused with *P. simiarum* Standley; *P. osaensis* C. M. Taylor of southern Costa Rica, previously confused with *P. deflexa* DC.; *P. paradichroa* C. M. Taylor of Panama, previously confused with *P. dichroa* (Standley) C. M. Taylor; *Psychotria sanblasensis* C. M. Taylor of eastern Panama, previously confused with *P. croceovenosa* Dwyer; *P. sinuata* C. M. Taylor of northwestern South America, similar to *P. angustiflora* K. Krause and distinguished by its usually sinuate to scalloped leaf margins; and *P. soejartoi* C. M. Taylor of northwestern South America, previously confused with *P. stenostachya* Standley. Also described and illustrated is a new subspecies, *P. simiarum* subsp. *chiapensis* of central and southern Mexico, which is allopatric with subspecies *simiarum* of coastal Veracruz, Mexico, to Panama. The name *P. buchtienii* (H. Winkler) Standley applies to a commonly collected species found from southern Mexico through Bolivia, for which a detailed description is presented; *P. buchtienii* has previously been confused with *P. officinalis* (Aublet) Sandwith. All of these species belong to *Psychotria* subg. *Heteropsychotria* (Rubiaceae, tribe Psychotrieae).

Key words: Neotropics, *Psychotria*, Psychotrieae, Rubiaceae.

The pantropical genus *Psychotria* L. (Rubiaceae: Psychotrieae) includes perhaps 2000 species of shrubs and small trees. This genus is characterized by the presences of raphides, relatively small, insect-pollinated, white flowers, ovules that are basal and solitary in each of the two ovary locules, four or usually five valvate corolla lobes, and drupaceous fruits with hard-walled, single-seeded pyrenes. In the Neotropics, two principal lineages have been identified within *Psychotria* in its broad sense, as well as several smaller ones. These large groups are *Psychotria* subg. *Psychotria* and *Psychotria* subg. *Heteropsychotria* Steyermark (Taylor, 1996; Nepokroeff et al., 1999). *Psychotria* subg. *Psychotria* is distinguished by its usually caducous stipules, of various forms; the generally gray or brown color of its dried specimens; and its fruits that are usually red or orange at maturity. This group is pantropical, though the plants of each region (e.g., Africa, the Pacific Islands, the Neotropics) appear to comprise separate lineages (Nepokroeff et al., 1999). *Psychotria* subg. *Psychotria* includes about 600 species worldwide with about 200 species in the Neotropics (Hamilton, 1989).

Psychotria subg. *Heteropsychotria* is a wholly Neotropical group that is distinguished by its persistent stipules, which are usually united around the stem into a continuous sheath with two lobes on each interpetiolar side; the generally green color of its dried specimens; and its fruits that are usually white, blue, or black at maturity. *Psychotria* subg. *Heteropsychotria* is similar to the Neotropical genus *Palicourea* Aublet, which comprises an additional 200 species (Taylor, 1996, 1997) and is apparently derived from within *Psychotria* subg. *Heteropsychotria*. *Palicourea* has been separated from *Psychotria* subg. *Heteropsychotria* based on its flowers that are apparently adapted for hummingbird pollination (Taylor, 1996) and its typically somewhat larger fruits. Plants of *Psychotria* subg. *Heteropsychotria* have generally fragrant, diurnal, white to yellow flowers with corollas generally 2–10 mm long (though sometimes nocturnal and/or up to 50 mm long, e.g., *Psychotria chiapensis* Standley). Their corollas have a wide range of internal pubescence patterns, including fully glabrous, barbate in the throat, or pubescent in part or all of the tube. These corollas are straight-sided to funnelform, or in some species they may be bent near the base and some-

times also gibbous (i.e., asymmetrically swollen) here. This last corolla form resembles that of *Palicourea*, in which the corollas have a well-developed tube and a swollen, usually gibbous base that is closed off by an internal ring of pubescence. Apparently nectar accumulates in this swollen corolla base and is protected from many insect visitors by this pubescent ring (Taylor, 1996). In addition to this swollen base and internal pubescence, flowers of *Palicourea* generally lack odor, are larger, regularly 5–50 mm long, and are brightly colored. However, the distinctions between *Palicourea* and *Psychotria* subg. *Heteropsychotria* are not completely clear, and recent molecular information indicates that pollination mode and the correlated floral morphology may have shifted repeatedly within this group. Thus, the hummingbird-pollinated plants classified in *Palicourea* apparently have been derived several times from different insect-pollinated lineages of subgenus *Heteropsychotria*. Such shifts in pollination mode with subsequent diversification of species have now been documented for several Rubiaceae genera (e.g., Kirkbride, 1997; Malcomber, 2002; Taylor, 1994), and probably are the source of much of the species diversity in this family.

Most if not all the species of *Psychotria* subg. *Heteropsychotria* are distylous, as are nearly all those of *Palicourea* (Taylor, 1997) and *Psychotria* subg. *Psychotria* (Hamilton, 1989). The flowers typically last for one day, but usually only one or a few flowers of the multiflowered inflorescence open each day, so an individual plant typically produces flowers for weeks or even months. Similarly, the fruits generally ripen a few at a time over a period of weeks or months. The fruits of *Psychotria* subg. *Heteropsychotria* are succulent, and usually watery and sometimes a little sweet-tasting. They are dispersed by birds (Blake & Loiselle, 1992; Loiselle & Blake, 1990), and typically are removed very soon after they are ripe (pers. obs.). In some species the fruits pass through several color stages before maturity, usually becoming yellow, then orange, then red, then finally black (e.g., *Psychotria racemosa* L. C. Richard); in these species, the black fruits are removed quickly, and frequently not observed by collectors.

During preparation of the Rubiaceae for the *Flora Mesoamericana*, the following undescribed species and subspecies of *Psychotria* subg. *Heteropsychotria* were discovered, and the commonly collected species previously treated as *P. officinalis* (Aublet) Sandwith was found to differ from the type of that name and to be correctly called by a different, little-used name.

Psychotria buchtienii (H. Winkler) Standley, Publ. Field Columbian Mus., Bot. Ser., 7: 303. 1931. *Uragoga buchtienii* H. Winkler, Repert. Sp. Nov. Regni Veg. 8: 4. 1910. TYPE: Bolivia. [La Paz] San Antonio bei Mapiri, 850 m, Dec. 1907, *O. Buchtien 1608* (lectotype, designated by Standley (1931: 303), B destroyed, photo at F; isotypes, F, US not seen microfiche). Figure 1C–E.

Shrubs or small trees flowering at 1 m tall, to 3 m tall, branched; stems glabrous. *Leaves* elliptic to ovate or lanceolate, 7.5–23.5 × 2.5–8.5 cm, at apex acute to usually acuminate and often somewhat falcate, at base obtuse to acute, drying papyraceous, adaxially glabrous and often rather shiny, abaxially puberulous to glabrous; secondary veins 7 to 10 pairs, not looping to interconnect or sometimes doing so weakly in distal part of blade, without domatia, adaxially venation plane, abaxially costa prominent, secondary veins prominulous, and remaining venation plane; margins plane; petioles 3–17 mm long; *stipules* persistent, glabrous to puberulous, united around stem, sheath 0.8–1.5 mm long, truncate or sometimes in those stipules subtending peduncles concave with lobes very closely grouped, lobes 2 on each side, deltoid to narrowly triangular, 1–2 mm long, acute. *Inflorescences* terminal, paniculate, pilosulous to puberulous, pale green to perhaps whitened; peduncles 1.5–4 cm long; branched portion pyramidal to cylindrical, 1.5–4 × 2–3 cm; secondary axes 1 to 4 pairs, the lowermost 1 to 2 pairs frequently reflexed, secondary axes all terminating in a single congested-dichotomous cymule, secondary axes not subtended by bracts at junction with primary axis; bracts enclosing flowers several, ligulate to narrowly so, 1–9 mm long with longer bracts external to shorter bracts, obtuse to acute, entire to ciliolate; *flowers* distylous, sessile in glomerules of 2 to 5; hypanthium cylindrical, ca. 0.5 mm, puberulous to pilosulous; *calyx* limb 0.3–0.8 mm long, puberulous, shallowly lobed, ciliolate; *corolla* funnelform, white to cream, externally puberulous or hirtellous sometimes becoming glabrescent, internally glabrous in basal half of tube and hirtellous in upper half of tube, tube 3–5 mm long, lobes triangular, 1–2 mm long, acute, abaxially smooth; *anthers* in short-styled form 1–1.8 mm long, exserted, in long-styled form ca. 1 mm long, included, situated in upper part of corolla tube (i.e., opposite hirtellous region); *stigmas* in short-styled form ca. 2 mm long, included, situated in upper part of corolla tube, in long-styled form ca. 0.5 mm, exserted. *Infructescences* to 8 × 7 cm, becoming purple; *fruits* subglobose, 4.5–

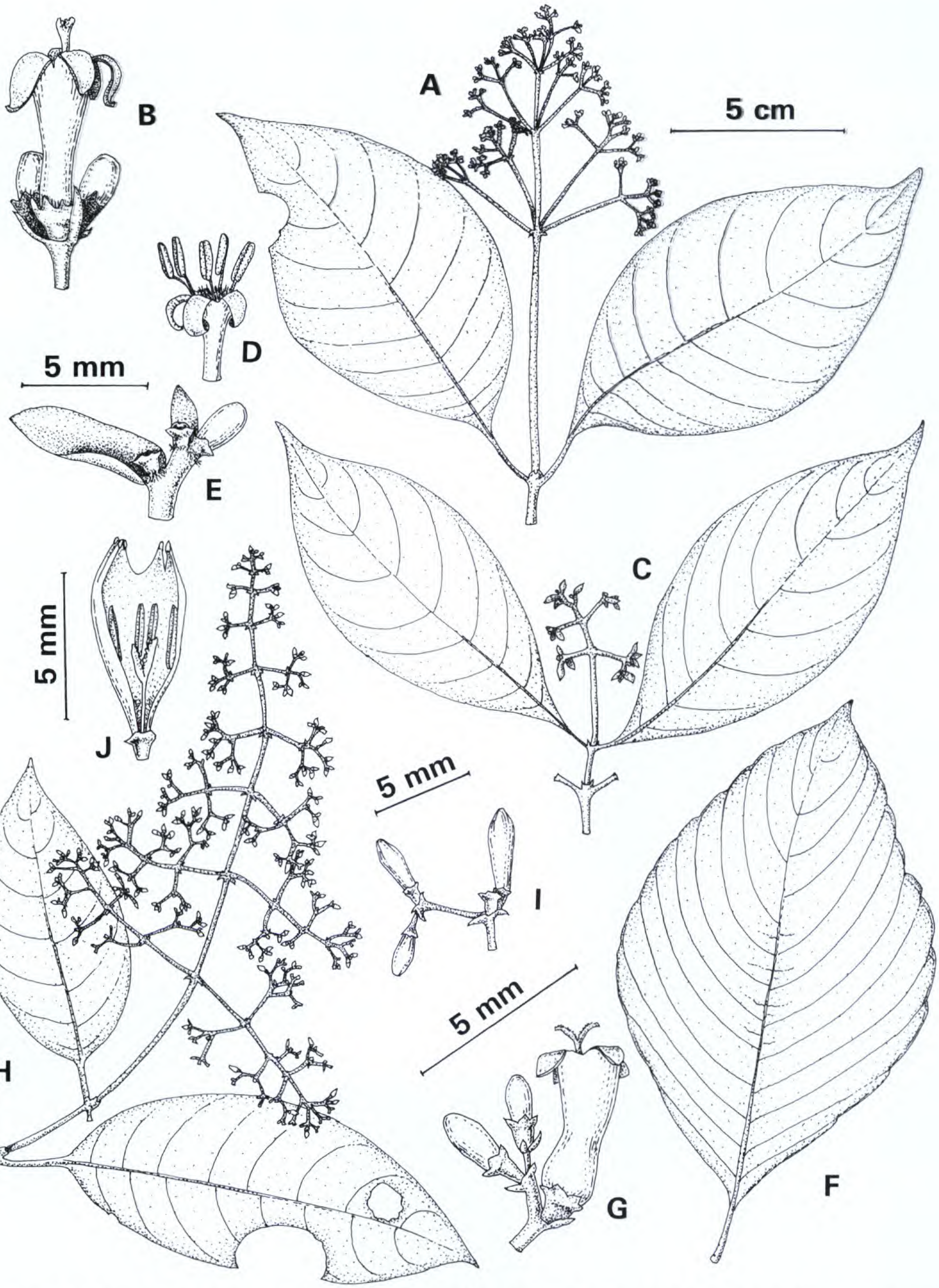

Figure 1. A, B. *Psychotria simiarum* subsp. *chiapensis* C. M. Taylor. —A. Stem with leaves and inflorescence; based on *Meave B-507*. —B. Detail of inflorescence with two young flower buds and one flower (apparently long-styled form) at anthesis; based on *Davidse et al. 20351*. C–E. *Psychotria buchtienii* (H. Winkler) Standley; C based on *Hammel 4195*; D, E based on *Hammel 4200*. —C. Stem with leaves and inflorescence. —D. Corolla at anthesis (short-styled form). —E. Detail of inflorescence with one young flower bud and two old flowers (from which corollas have fallen). F, G. *Psychotria sinuata* C. M. Taylor; based on *Forero 6782*. —F. Leaf. —G. Detail of inflorescence with two young flower buds and one flower (apparent long-styled form) at anthesis. H–J. *Psychotria sanblasensis* C. M. Taylor; based on *de Nevers 4123*. —H. Stem with leaves and inflorescence. —I. Detail of inflorescence, with three flower buds and one old flower (from which corolla has fallen). —J. Mature flower bud (short-styled form), shortly before anthesis, partially dissected. A, C, F, H to 5-cm scale; B, G to same 5-mm scale; D, E to same 5-mm scale.

5 mm diam., puberulous or pilosulous to glabrous, black or purple-black; *pyrenes* 2, planoconvex, dorsally with 4 to 5 rather sharp longitudinal ridges, adaxially (ventrally) with a central "Y"-shaped depression.

Habitat, distribution, and phenology. In wet forest at 0–1300 m, southern Mexico to Bolivia; collected in flower and fruit generally throughout the year.

This species is distinguished by its branched inflorescences with congested cymules and well-developed floral bracts, corolla tubes 3–5 mm long, subglobose fruits, and pyrenes with a "Y"-shaped indentation near the center of the adaxial (ventral) face. It is commonly collected, in particular in Central America and northwestern South America. *Psychotria buchtienii* has been confused with *P. officinalis* for a long time (e.g., Standley, 1938; Standley & Williams, 1975; Dwyer, 1980; Burger & Taylor, 1993; Taylor, 2001), but in fact that latter name correctly applies to a species that is restricted to northeastern South America and apparently allopatric to *P. buchtienii*. *Psychotria officinalis* differs from *P. buchtienii* in its slender, usually very low habit, its slender corymbiform inflorescences with umbelliform secondary axes and the primary axis usually not well developed, its very narrow to linear bracts, its corolla tubes 2.5–3 mm long, and its pyrenes with a linear longitudinal sulcus on the adaxial face. *Psychotria buchtienii* has also been confused with *P. gracilenta* Mueller Argoviensis and *P. hoffmannseggiana* (Roemer & Schultes) Mueller Argoviensis, both of which are sympatric and have inflorescences or at least infructescences of similar arrangement with well-developed bracts. However, both of these last species also differ from *P. buchtienii* in their pyrenes, which have a linear longitudinal sulcus on the adaxial face. Details of pyrene morphology have been considered taxonomically informative in the Psychotrieae for recognizing genera and species groups by several authors (review in Piesschaert, 2001), and pyrene morphology has generally been found consistent at the species level (Piesschaert et al., 2001). The "Y"-shaped indentation on the adaxial face of the pyrenes of *P. buchtienii* does not closely match patterns documented for other species of *Psychotria* subg. *Heteropsychotria*. Pyrene morphology shows considerable variation in many lineages of Psychotrieae (Piesschaert, 2001; Piesschaert et al., 2001), and relatively very few species of *Psychotria* subg. *Heteropsychotria* have even been studied.

Because of the large number of specimens of this overlooked and confused species, selected specimens are cited as vouchers for geographic distribution below (with countries arranged from north to south but their political units alphabetical), and the remainder of the specimens examined are listed in Appendix 1.

Selected specimens examined (see also Appendix 1). MEXICO. **Chiapas:** 10 km ENE of Dos Lagos above Santa Elena, *D. Breedlove & Almeda 57617* (MO). CENTRAL AMERICA. BELIZE. **Cayo:** Maya Mtns., Smokey Branch, *A. Monro & Helgason 387* (MO). **Stann Creek:** Cockscomb Mtns., tributary of Cocoa Branch of Sitte River, 2 km due N of Victoria Peak, *A. Gentry 7925* (MO). **Toledo:** Camp 3, 6–8 km SW of Union Camp, trail from Camp 3 toward Cabro on Jimmy Cut trail, *T. Hawkins 1454* (MO). GUATEMALA. **Alta Verapaz:** bordering Rio Sebol ca. 12 km below Sebol, *E. Contreras 4204* (MO). **Izabal:** Cadenas/Puerto Méndez, on Toquela River Road, *E. Contreras 9073* (MO). **Petén:** San Diego, Río Pasión, *M. Aguilar H. 506* (MO). HONDURAS. **Cortés:** near Agua Azul, Lake Yojoa, *L. O. Williams & Molina 17917* (MO). NICARAGUA. **Jinotega:** Salto Kayaska, Río Bocay, *W. D. Stevens et al. 16535* (MO). **Zelaya:** Cerro La Pimenta Number 1, summit and area adjacent to summit, *J. Pipoly 5091* (MO). COSTA RICA. **Cartago:** Turrialba, Tayutic, Fila Vereh, alto entre Cuenca del Río Vereh y el Jicotea, *A. Cascante 625* (MO). **Guanacaste:** Parque Nac. Guanacaste, Estación Pitilla, *I INBio 39* (MO). **Heredia:** Finca La Selva, the OTS field station on the Río Puerto Viejo just E of junction with Río Sarapiquí, *Damon Smith 310* (MO). **Limón:** 7 km SW of Bribri, *L. D. Gómez et al. 20325* (MO). **Puntarenas:** top of Ridge Road, near Rincón de Osa, *H. Kennedy 1969* (MO). **San José:** vicinity of El General, *A. Skutch 2165* (MO). PANAMA. **Bocas del Toro:** along road from Fortuna Dam to Chiriquí Grande, *G. McPherson 8428* (MO). **Chiriquí:** along road in vicinity of branch in road to Cerro Colorado and Escopeta, above Río San Felix near town of San Felix, *T. Croat 33420* (MO). **Coclé:** top of El Petroso, *W. D'Arcy 11365* (MO). **Darién:** S of El Real, region called Alturas de Nique, near Cana mine, *G. McPherson 11502* (MO). **Herrera:** 18 km W of Las Minas, *Hammel 4195* (MO), *4200* (MO). **Panamá:** Cerro Jefe area, near Altos de Pacora, *W. D'Arcy & Sytsma 14746* (MO). **Veraguas:** above primero brazo del Río Santa María, N of Escuela Agrícola Alto de Piedra, just W of Santa Fe, *S. Knapp & Dressler 5282A* (MO). SOUTH AMERICA. COLOMBIA. **Amazonas:** mpio. Leticia, Parque Nac. Nat. Amacayacu, Centro Administrativo Mata-matá, *A. Rudas et al. 1408* (MO), *1580* (MO). **Antioquia:** Parque Nac. Nat. Las Orquídeas, sector Calles, *A. Cogollo & Ramírez 3148* (MO), *A. Cogollo et al. 3396* (MO). **Chocó:** mpio. Riosucio, zona de Urabá, Cerros del Cuchillo, *D. Cárdenas 269* (MO), *386* (MO), *982* (MO), *1743* (MO), *2106* (MO). **Guaviare:** mpio. San José del Guaviare, sector de laguna Pavón II, territorio Nukak, *D. Cárdenas et al. 7127* (MO). **Magdalena:** Alto Río Buritaca, Alto de Mira, *S. Madriñón & Barbosa 320* (MO). **Meta:** mpio. Mesetas, Inspección de Policía Uribe, vereda Brisas del Río Duda, *J. Betancur 1278* (MO). **Putumayo:** mpio. Mocoa, correg. San Antonio, vereda Alto Campucana, Finca La Mariposa, *J. Betancur et al. 5205* (MO). **Risaralda:** mpio. Mistrató, correg. Geguadas, zonas de Geguadas y Carrema, *J. L. Fernández A. et al. 9497* (MO). **Valle:** mpio. Buenaventura, correg. Córdoba, San Cipriano, Reserva Nat. Río Escalerete, *W. Devia et al. 3967* (MO), *4469* (MO), *5746*

(MO), *5755* (MO), *5594* (MO). ECUADOR. **Carchi:** 5 km from Lita, *A. Barfod et al. 41353* (AAU, MO). **Esmeraldas:** cantón Eloy Alfaro, Reserva Ecológica Cotacachi-Cayapas, Charco Vicente, *M. Tirado et al. 364* (MO). **Sucumbíos:** cantón El Chaco, Río Granadillo, campamento de Inecel "Codo Alto," *W. Palacios 5529* (MO). **Napo:** Reserva Florística El Chuncho, Payamino, Estación Exp. INIAP-Napo, *C. Cerón 2486* (MO), *W. Palacios et al. 1160* (MO), *C. Persson 134* (MO), *J. Zaruma 433* (MO); cantón Archidona, Parque Nac. Sumaco Napo-Galera, Cordillera de Galeras, *E. Freire & Cerda 545* (MO); Reserva Biol. Jatun Sacha, Río Napo, 8 km al E de Misahuallí, *C. Cerón 965* (MO), *C. Cerón et al. 4622* (MO), *D. Neill & Manning 8016* (MO). **Pastaza:** Río Curaray, alrededores de Laguna Garzayacu, *D. Neill & Palacios 6729* (MO). PERU. **Amazonas:** Quebrada chigku shinuk, *R. Kayap 624* (MO). **Cusco:** Acuartambo, Conipata Valley, Río Tono Road N of Patria, *R. Foster et al. 10596* (MO). **Huánuco:** Leoncio Prado, Rupa Rupa, al E de Tingo María, cerca al cerro Quemado, *J. Schunke V. 9935* (MO). **Loreto:** Maynas, Yanamono, Explorama Tourist Camp on Río Amazonas between Indiana and mouth of Río Napo, *A. Gentry et al. 29038* (MO). **Pasco:** Oxapampa, W side of Cordillera de San Matias between Iscozacin and summit, *David Smith 2062* (MO). **Puno:** Sandia, between Río Azata-Colorado, *P. Núñez & Muñoz 5315* (MO). **San Martín:** Lamas, caserío Bonilla, trail to E of road, Km 75 of Tarapoto–Yurimaguas road, *S. Knapp & Mallett 7132* (MO). **Ucayali:** Coronel Portillo, Cordillera Azul, Km 64 on Tingo María–Pucallpa road, 1 km E of Puente Cholon, *K. Young & Sullivan 686* (MO). BOLIVIA. **La Paz:** Nor Yungas, 13.7 km NW of San Pedro on road through Incahuara-Mejillones and along trail to 12 de Octubre, *J. Solomon 9272* (MO).

Psychotria calidicola C. M. Taylor, sp. nov. TYPE: Costa Rica. Limón: Parque Nacional Tortuguero, sobre el Río Tortuguero, ca. 3 km al SO del pueblo, 10°31′N, 83°30′W, 12 Oct. 1988, *R. Robles 2100* (holotype, CR; isotype, MO-03644674). Figure 2A–D.

Haec species a *Psychotria eurycarpa* inflorescentiae axe glabro, tubo corollino 13–14 mm longo atque fructu 15–20 × 12–20 mm distinguitur; quam ea altitudines humiliores habitat.

Shrubs or usually small trees to 8 m tall, branched; stems glabrous. *Leaves* elliptic to broadly so, oblanceolate or obovate, 8–20 × (3.0, Osa Peninsula–)3.5–12 cm, at base acute to cuneate or somewhat obtuse, at apex acute to somewhat acuminate, drying papyraceous, on both surfaces glabrous and often shiny; secondary veins 5 to 7 pairs, looping to interconnect, without domatia, adaxially costa and secondary veins a little thickened and remaining venation plane, abaxially costa prominent, secondary veins prominulous, and remaining venation plane to a little thickened; margins plane; *petioles* 1–3.2 cm long; *stipules* persistent, glabrous, shortly united around stem, with interpetiolar portion 0.5–3.5 mm long, broadly rounded to subtruncate, entire to denticulate with teeth 2 per side, to 0.2 mm long. *Inflorescences* terminal, paniculate, green, glabrous; peduncles 1.5–4 cm long; branched portion corymbiform, 3–4 × 6–10 cm, with secondary axes 3 pairs, dichasial, with basal 2 pairs usually closely grouped to subverticillate; bracts acute, those subtending secondary axes lacking or usually triangular to linear, 1–2 mm long, those subtending flowers linear to narrowly ligulate or triangular, 0.2–1 mm long; *flowers* distylous, apparently diurnal, sessile at ends of inflorescence axes in cymules of 5 to 9; hypanthium turbinate to ellipsoid, ca. 1 mm long, glabrescent; *calyx* limb 0.5–0.8 mm long, glabrous, sinuate to denticulate; *corolla* salverform, white, externally puberulous to glabrescent, internally glabous except puberulous below middle of tube, tube 13–14 mm long, lobes 5 to 7, narrowly ligulate, 6–8 mm long, abaxially a little thickened and rounded; *anthers* in short-styled form ca. 3.5 mm long, partially exserted, in long-styled form ca. 3 mm long, included, situated near middle of corolla tube; *stigmas* in short-styled form ca. 3 mm long, included, situated just above middle of corolla tube, in long-styled form ca. 2 mm long, exserted. *Infructescences* similar to inflorescences; *fruits* obovoid to ellipsoid, 15–20 × 12–20 mm, laterally somewhat flattened, glabrescent, mature color not noted; *pyrenes* 2, planoconvex, dorsally with 4 to 5 low obtuse ridges.

Habitat, distribution, and phenology. In wet forests of Atlantic slopes at 0–800 m, southeastern Nicaragua to western Panama; collected in flower February through April, in fruit January, February, and September through December.

This new species has previously been confused with *Psychotria eurycarpa* Standley (Taylor, 1991, 2001; Bawa & Beach, 1983; Dwyer, 1980). However, *Psychotria eurycarpa* differs from this new species in its shorter corolla tubes (11–12 mm long), generally smaller leaves (5.5–15 × 2.5–7 cm), puberulous inflorescence axes, and smaller fruits (8–12 mm diam.). Additionally, *P. eurycarpa* has been collected in flower April through July, and generally inhabits premontane forests at higher elevations, 700–1500 m. The specific epithet refers to the habitat of this new species, in warmer forests at lower elevations. The floral biology of *P. calidicola* was studied by Bawa and Beach (1983), as "*Coussarea* sp. voucher *JHB 1424*."

The fruits are described as turning red at maturity (*Robles 2100*), which would be highly unusual in *Psychotria* subg. *Heteropsychotria* as a mature color but not as an intermediate color before the fruits finally become blue or black. The flowers are reported to be fragrant by several collectors, and

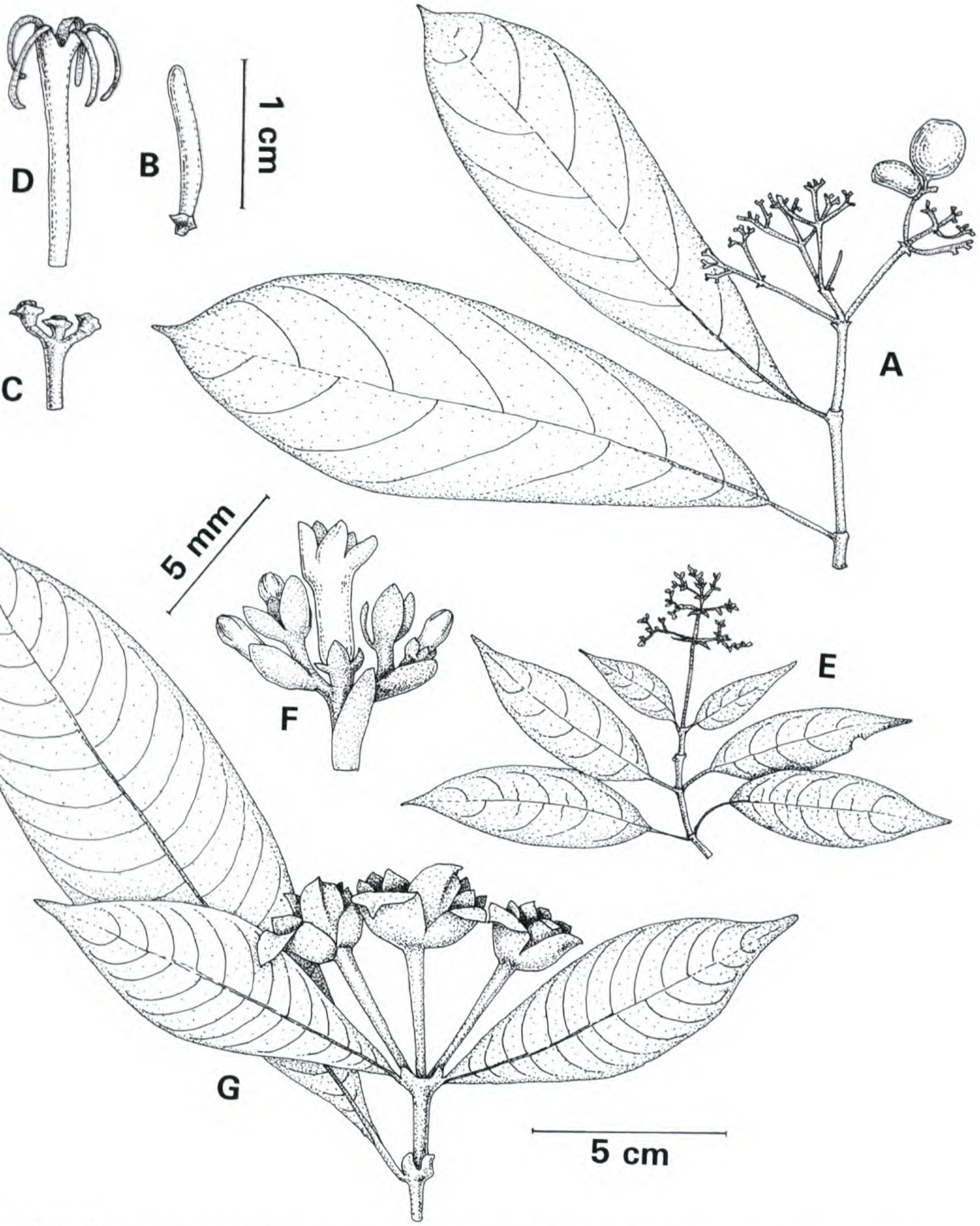

Figure 2. A–D. *Psychotria calidicola* C. M. Taylor; A based on *Will 12/08/99/98*; B, C based on *G. Herrera 2597*. —A. Stem with leaves and infructescence. —B. Flower bud. —C. Detail of inflorescence with three old flowers (from which corolla has fallen). —D. Corolla at anthesis (short-styled form); based on *G. Herrera 2597*. E, F. *Psychotria gaitalensis* C. M. Taylor. —E. Stem with leaves and inflorescence; based on *Stein & Hamilton 1011*. —F. Detail of inflorescence showing several flower buds and one bud (before anthesis, with corolla lobes spreading probably as an artifact of drying); based on *McPherson 11967*. —G. *Psychotria paradichroa* C. M. Taylor, stem with leaves and inflorescence; based on *Dressler 3317*. A, E, G to 5-cm scale; B, C, D to 1-cm scale.

Grayum (*Grayum 6986*) found them particularly striking: ". . . Flowers emitting an intoxicatingly sweet, frangipani-like fragrance (1 PM)."

Paratypes. COSTA RICA. **Alajuela:** 15 km WNW of Quesada by air 1 km W of Jabillos, *R. Liesner et al. 15178* (MO). **Heredia:** N of Puerto Viejo, 12 km to ferry, over ferry, 6 km along road, *N. Garwood et al. 946* (MO); area between Río Peje and Río Sardinalito, Atlantic slope of Volcán Barva, *M. Grayum 6986* (MO); Finca La Selva, the

OTS Biological Station 3 km S of Puerto Viejo, *G. Hartshorn 1135* (MO), *1786* (MO, sterile), *B. Loiselle 167* (MO). **Limón:** Parque Nac. Tortuguero, *K. Barringer et al. 1929* (MO); Estación Cuatro Esquinas, *R. Delgado 102* (MO); Pococí, Estación Agua Fria, 3 km al NE siguiendo el curso del Río Agua Fria, *R. Robles & Flores 1634* (MO); sendero Agua Fria hasta entrada Sendero Aguacate, *J. Solano 280* (MO); Hacienda Tapezco-Hacienda La Suerte, 29 km by air W of Tortuguero, *C. Davidson 6879* (MO), *6978* (MO); Cordillera de Talamanca, along Quebrada Cañabral, from Río Barbilla to ca. 1.5 km upstream, *M. Grayum et al. 8860* (MO); cantón Pococí, cuenca Tortuguero-Sierpe, entrada a Finca Bananera Geest, Estación Casa Verde, ca. 16 km NE de Cariari, *B. Hammel & Grayum 20745* (MO); Cordillera de Talamanca, Matina, al NE de la confluencia de Quebrada Cañabral con Río Barbilla, Fila Suita, *G. Herrera 2172* (MO); cantón Limón, El Progreso, entre Cerro Muchilla y Cerro Avioneta, siguiendo la Fila Matama, Valle de La Estrella, *G. Herrera 2597* (MO); Siquirres, Las Brisas, margen izquierda de quebrada Jesús, camino a Cerro Tigre, *G. Herrera & Valverde 8851* (MO); along river near Experiment Station Los Diamontes, Guápiles, *R. Lent 321* (MO); near Río Parismina, 8 km W of Dos Bocas, *R. Lent 2451* (MO); Reserva Biol. Hitoy-Cerere, alrededores de la Estación, Valle de La Estrella, *A. Moreno 23* (MO); Cerro Tortuguero, ladera NW, 4 km al N de Tortuguero, rumbo a la Barra del Colorado, *R. Robles 2116* (MO). **Puntarenas:** cantón Golfito, Reserva Forestal Golfo Dulce, Aguabuena 3.5 km W of Rincón, *K. Thomsen 786* (MO); Aguabuena, sector N, *R. Aguilar 684* (MO); Serranías de Golfito detrás de Esquinas Rainforest Lodge, entre Villa Bricena y Golfito, *B. Hammel et al. 20490* (MO); cantón Osa, camino a la toma de agua, Rancho Quemado, Rincón, *F. Quesada 305* (MO); cantón Osa, tierras del Grupo de Conservación de Rancho Quemado, Sierpe, *J. Marín 226* (MO); La Gamba, Parque Nacional Esquinas, *S. Will 13/08/99/98* (MO). **San José:** Zona Protectora La Cangreja, Mastatal de Puriscal, *J. Morales & Jiménez 909* (MO). NICARAGUA. **Zelaya:** mpio. Waspan, Reserva Bosawas, sobre el Río Waspuk, 300 m después del rápido wavla kumbas, luego O hasta el cerro Suyakno Tuná Azan, *R. Rueda et al. 4971* (MO); mpio. El Castillo, Reserva Indio-Maíz, Cerro El Diablo, *R. Rueda et al. 5431* (MO). PANAMA. **Bocas del Toro:** al O del campamento Corriente Grande (IRHE), *M. Correa et al. 3712* (MO, PMA); just above Quebrada Menaco on Chiriquí trail, *J. H. Kirkbride & Duke 661* (MO).

Psychotria chocoana C. M. Taylor, sp. nov. TYPE: Colombia. Chocó: Jequedó, 42 km W of Las Animas E of Río Pato on Pan American Highway (under construction), ca. 250 m, 11 Jan. 1979, *A. Gentry & E. Rentería A. 23998* (holotype, HUA-16395; isotype, MO-2719115). Figure 3B–D.

Haec species a congeneris *Psychotria* subgeneris *Heteropsychotriae* stipularum lobulis ligulatis sat grandibus, inflorescentiae axibus secundariis subverticillatis flores sessiles in glomerulos parvos numerosos gerentibus, limbo calycino extus puberulo glabrescenteve intus dense hirtello atque fructuum sat grandium pyrenis dorsaliter laevibus distinguitur.

Shrubs or perhaps small trees flowering at 8 m tall; stems glabrous, quadrate often becoming somewhat channeled longitudinally. *Leaves* elliptic to broadly so or somewhat oblong, 13–25 × 5–13 cm, at apex rounded or somewhat acuminate, at base cuneate to obtuse, drying papyraceous to chartaceous, adaxially and abaxially glabrous; secondary veins 9 to 13 pairs, not or weakly looping to interconnect, without domatia, adaxially costa and secondary veins prominulous and remaining venation plane, abaxially costa prominent, secondary veins prominulous, and reticulated higher order venation plane to thickened; margins plane; petioles 2.5–4 cm long; *stipules* persistent, glabrous, united around stem, sheath subtruncate, ca. 5 mm long, lobes 2 per side, ligulate to narrowly elliptic, 10–16 mm long, obtuse to rounded. *Inflorescences* terminal, paniculate, puberulous to hirtellous, apparently green; peduncles 2–7.5 cm long; branched portion 8–13.5 × 7–13 cm, corymbiform to broadly pyramidal; secondary axes 7 to 8 pairs, branched, pairs often closely grouped to subverticillate; bracts triangular to ligulate, acute to rounded, those subtending secondary axes 1.5–4 mm long, those subtending flowers 1–2 mm long; *flowers* sessile in glomerules of 5 to 15; hypanthium turbinate to cupuliform, ca. 0.5 mm long, glabrescent; *calyx* limb 1–1.5 mm long, externally puberulous to glabrescent, internally densely hirtellous, deeply lobed, lobes broadly rounded to obtuse; *corolla* tubular-funnelform, white, externally glabrous, internally glabrous except densely hirtellous at and just above stamen insertion, tube ca. 3.5 mm long, ca. 2.5 mm diam. near middle, lobes 5, narrowly triangular, ca. 3 mm long, acute, abaxially thickened with appendage rounded to broadly triangular; *anthers* ca. 1.5 mm long, partially exserted; *stigmas* not seen. *Infructescences* similar to inflorescences; *fruits* ellipsoid, ca. 10 × 8 mm, glabrous, mature color not noted; pyrenes 2, planoconvex, dorsally smooth.

Habitat, distribution, and phenology. In wet forests at ca. 250 m, northwestern Colombia; collected in flower in January, in fruit in August.

This new species is distinguished by its stipules united around the stem into a continuous sheath with two relatively well-developed lobes (10–16 mm long) on each side, inflorescences with the secondary axes often closely grouped to subverticillate, flowers sessile in numerous small glomerules, calyx limbs densely hirtellous on the internal (i.e., adaxial) surface, and relatively large fruits (ca. 10 × 8 mm) with the pyrenes smooth dorsally. It is so far known only from Chocó Department in northwestern Colombia, and the specific epithet refers to this distribution. Many of the plant species with this

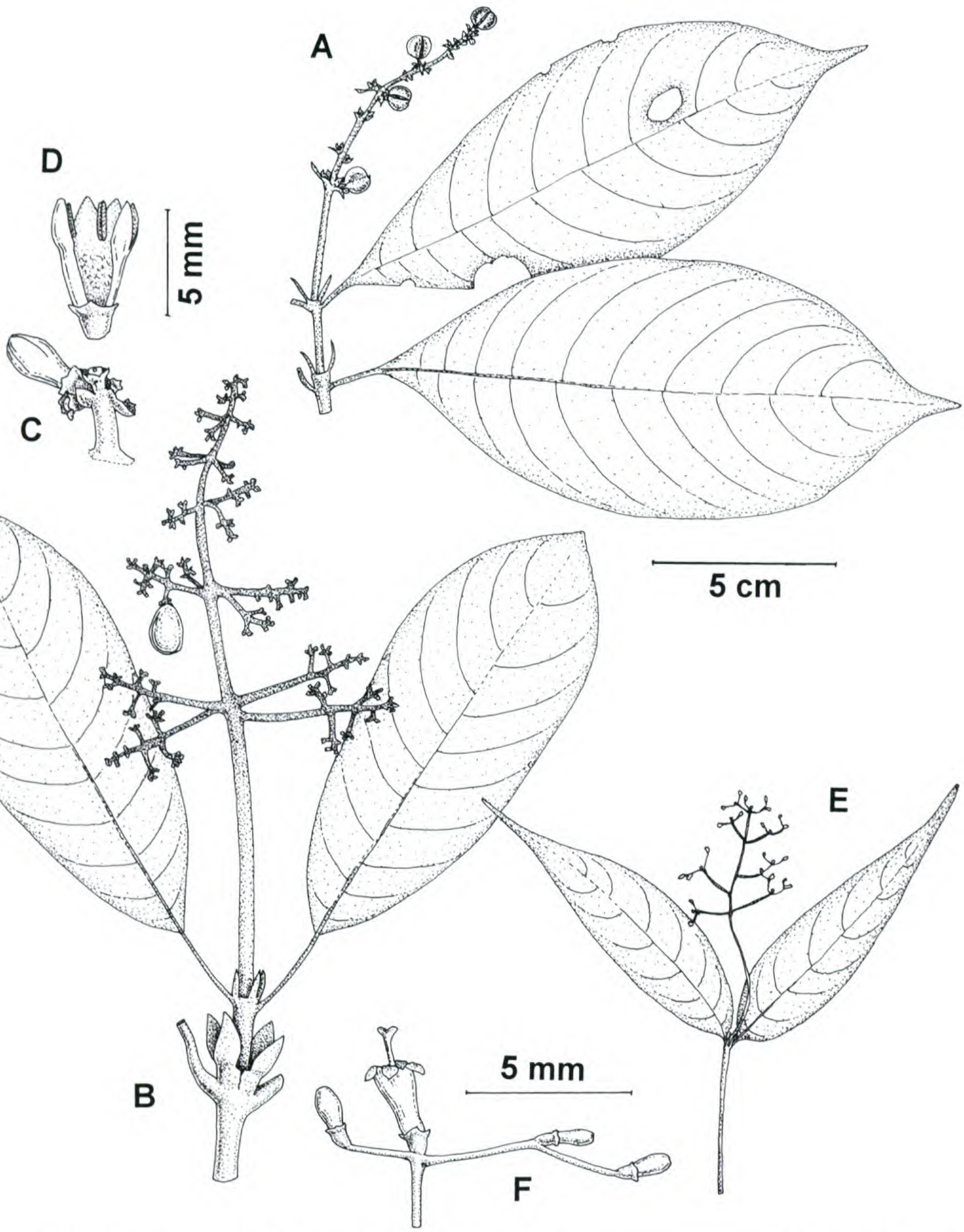

Figure 3. —A. *Psychotria soejartoi* C. M. Taylor, stem with leaves and infructescence; based on *Cogollo 864*. B–D. *Psychotria chocoana* C. M. Taylor; B based on *Arias 65*; C, D based on *Gentry & Rentería 23998*. —B. Stem with leaves, stipules, and infructescence. —C. Detail of inflorescence with flower bud and three old flowers (from which corolla has fallen). —D. Flower at anthesis, partially dissected. E, F. *Psychotria osaensis* C. M. Taylor; based on *Kernan & Phillips 661*. —E. Stem with leaves and inflorescence. —F. Detail of inflorescence with three flower buds and one flower (apparent long-styled form) at anthesis. A, B, E to 5-cm scale; C, D to same 5-mm scale.

distribution are found from eastern Panama through coastal Pacific Colombia to northwestern Ecuador, and *Psychotria chocoana* may be more widely distributed in this poorly collected South American region.

This new species is similar in general aspect as well as fruit size and morphology to *Psychotria allenii* Standley; *P. allenii* differs from *P. chocoana* in its stipules with deltoid lobes 2–4 mm long, its secondary leaf veins 5 to 10 pairs, and its shorter calyx limbs, ca. 0.3 mm long.

Paratypes. COLOMBIA. **Chocó:** mpio. Quibdó, cor-

regimiento Tutunendo, carretera a Medellín, *L. Arias 65* (CHOCO, MO); mpio. Bahía Solano, en la trocha entre Bahía Solano y el Río Juá, *J. Espina et al. 3071* (HUA).

Psychotria gaitalensis C. M. Taylor, sp. nov. TYPE: Panama. Coclé: above El Valle, on trail to top of Cerro Gaital, 8°40′N, 80°10′W, 1050–1180 m, 22 Jan. 1988, *G. McPherson 11967* (holotype, PMA; isotype, MO). Figure 2E, F.

Haec species a congeneris stipulis circum caulem connatis vaginam truncatam continuam formantibus, bracteis floralibus bene evolutis, limbo calycino profunde lobato sed bene evoluto atque tubo corollino 3–4 mm longo distinguitur.

Shrubs and small trees flowering at 2 m tall, to 3 m tall; stems glabrous. *Leaves* narrowly elliptic, 4.5–10 × 1–3 cm, at apex acute to a little acuminate, at base acute to cuneate, drying subcoriaceous, glabrous on both surfaces; secondary veins 5 to 7 pairs, not looping to interconnect or doing so weakly near apex, without domatia, adaxially venation plane or costa thickened, abaxially costa prominent, secondary veins plane to prominulous, and remaining venation plane and mostly not visible; margins plane; petioles 4–9 mm long; *stipules* persistent, united around stem, sheath 1–2 mm long, truncate, externally glabrous, internally glabrous except at base enclosing a dense ring of colleters to 1 mm long. *Inflorescences* terminal, paniculate, glabrous, apparently green; peduncles 2.2–4 cm long; branched portion pyramidal, 1.5–4 × 2–4 cm; secondary axes 2 to 5 pairs, branched to several orders; bracts narrowly elliptic to narrowly ligulate, obtuse to rounded, glabrous, those subtending secondary axes 3–5 mm long, those subtending flowers 1–2 mm long; *flowers* sessile in dichasial cymules of 5 to 7, each usually subtended by 2 to 4 bracts; hypanthium turbinate, 0.5–0.8 mm long, glabrous; *calyx* limb 0.8–1 mm long, glabrous, lobed nearly completely, lobes deltoid to ligulate, obtuse, usually a little unequal on an individual flower; *corolla* tubular, yellow to white sometimes tinged with purple, externally glabrous, internally glabrous except densely hirtellous in a ring just above middle of tube and sparsely pubescent in tube above this, tube 3–4 mm long, lobes 5, ligulate, 1–1.5 mm long, abaxially a little thickened; *anthers* ca. 1 mm long, included, situated just below corolla throat; *stigmas* ca. 0.3 mm long, exserted. *Infructescences* apparently similar to inflorescences; fruits ellipsoid, ca. 3 × 2.5 mm, laterally somewhat flattened, glabrous, mature color not noted; *pyrenes* 2, planoconvex, dorsally with 4 to 5 narrow longitudinal ridges.

Habitat, distribution, and phenology. In wet premontane and cloud forests at 900–1400 m in western Panama; collected in flower in January and December, in fruit in January and July.

This new species is distinguished by its combination of relatively small leaves, stipules that are united around the stem into a continuous, unlobed, truncate sheath, relatively small inflorescences with the floral bracts well developed, deeply lobed relatively well developed calyx limbs, and corollas with tubes 3–4 mm long. The specific epithet refers to the type locality. In its general aspect *Psychotria gaitalensis* is similar to *P. simiarum* Standley; *P. simiarum* differs from *P. gaitalensis* by its smaller floral bracts, 0.2–1.2 mm long, that are narrowly triangular to linear, and its shorter calyx limbs, 0.3–1 mm long, that are only shallowly lobed. The leaves of *P. gaitalensis* appear to be rather succulent in life. The flowers seen of *P. gaitalensis* are similar to the long-styled form of distylous *Psychotria* species.

Paratypes. PANAMA. **Coclé:** slopes and summit of Cerro Gaital, N of El Valle, *S. Knapp et al. 5976* (MO); divide SW of La Mesa at end of logging road, *B. Stein & Hamilton 1011* (MO).

Psychotria osaensis C. M. Taylor, sp. nov. TYPE: Costa Rica. Puntarenas: Parque Nacional Corcovado, Sirena, Los Patos forest, 8°28′N, 83°35′W, 1–50 m, 8 July 1989, *C. Kernan 1211* (holotype, CR; isotype, MO-4590639). Figure 3E, F.

Haec species a *Psychotria deflexa* petiolo 1–3 mm longo, inflorescentia semper ebracteata atque tubo corollino 2.5–3.5 mm longo distinguitur.

Shrubs or small trees to 3.5 m tall, branched, erect; stems puberulous to glabrous. *Leaves* lanceolate, 5–12 × 1–2.8 cm, at apex slenderly acute to acuminate, at base acute to obtuse, drying papyraceous, adaxially glabrous, abaxially puberulous to glabrous; secondary veins 5 to 7 pairs, not looping to interconnect or sometimes doing so near apex, without domatia, adaxially venation plane or costa prominulous, abaxially costa and secondary veins prominulous and tertiary veins plane or sometimes thickened; petioles 1–3 mm long; *stipules* persistent, puberulous, united around stem, sheath 0.3–0.5 mm long, truncate to concave, lobes 2 per side, linear to narrowly triangular, 1.5–3 mm long, acute. *Inflorescences* terminal, paniculate, puberulous; peduncle 2.5–4 cm long, flexuous, slender; branched portion cylindrical to narrowly pyramidal, 2–4 × 2–3 cm, with secondary axes produced at 2 to 4 nodes, 2 per node, terminating in a 3- to 5(7)-flowered dichasial cyme; bracts none; *flowers* sessile;

hypanthium cylindrical to cupuliform, 0.3–0.5 mm long, puberulous; *calyx* limb 0.2–0.3 mm long, puberulous, sinuate to shallowly lobed; *corolla* funnelform, white, externally glabrous to puberulous, internally glabrous except with a hirtellous ring near middle of tube, tube ca. 2 mm long, lobes 5, triangular, ca. 1 mm long, abaxially smooth; *anthers* in apparent long-styled form ca. 0.5 mm long, included, situated in corolla throat; *stigmas* 2, in apparent long-styled form linear, ca. 0.3 mm long, exserted. *Infructescences* similar to inflorescences, becoming purple; *fruits* ellipsoid, ca. 2 × 3 mm, laterally a little flattened, puberulous to glabrescent, purple; *pyrenes* 2, planoconvex, dorsally with 3 to 4 obtuse angles and surface irregularly pitted.

Habitat, distribution, and phenology. In wet forest at 1–500 m on the Osa Peninsula of southern Costa Rica; collected in flower in July, in fruit in October.

This new species is similar to *Psychotria deflexa* DC., and has been previously combined with it (e.g., Burger & Taylor, 1993). However, *P. deflexa*, which is sympatric (e.g., *R. Liesner 3198*, MO; *D. Janzen, 10406*, MO), differs consistently in its generally more robust habit and inflorescences, longer petioles (3–12 mm long), inflorescences usually with at least a few bracts, longer corolla tubes (2.5–3.5 mm long), and larger fruits (2.5–3.5 mm long). *Psychotria osaensis* is only known from a small region on the Osa Peninsula, a phytogeographically distinct part of Costa Rica; the specific epithet refers to this distribution. Only a few flowering collections have been seen, and it is not clear if this species is distylous. The flowers seen resemble the long-styled flowers of distylous species.

Paratypes. COSTA RICA. **Puntarenas:** Parque Nac. Corcovado, Los Patos Forest, *C. Kernan & Phillips 661* (CR, MO); Los Patos, Río Sirena Trail, *C. Kernan 1331* (CR, MO); trail from Los Chiles to base of hills, *R. Liesner 3199* (MO).

Psychotria paradichroa C. M. Taylor, sp. nov. TYPE: Panama. Panamá: Cerro Jefe in *Clusia* forest, 2700–3000 ft., 27 Jan. 1966, *E. L. Tyson, J. Dwyer & K. Blum 3285* (holotype, PMA; isotype, MO-1321251). Figure 2G.

Haec species a *Psychotria dichroa* inflorescentia fasciculata alba cremea vel pallide lutea pedunculo 1–4 cm longo insidente atque bracteis floralibus acutis usque acuminatis distinguitur.

Shrubs and small trees flowering at 2 m tall, to 5 m tall; stems glabrous. *Leaves* narrowly elliptic-oblong to narrowly oblanceolate, 6–25 × 2–6 cm, at apex acute to usually acuminate, at base acute to cuneate, drying chartaceous to subcoriaceous, adaxially glabrous and shiny, abaxially glabrous and dull; secondary veins 10 to 24 pairs, ascending to often spreading at 90° or more from costa, usually looping to interconnect, without domatia, adaxially costa and secondary veins prominulous and remaining venation plane, abaxially costa prominent and remaining venation plane; petioles 3–25 mm long; *stipules* persistent, glabrous, united around stem into a continuous sheath or with intrapetiolar portion reduced, sheath 2–3 mm long, truncate, lobes 2 per side, triangular to ligulate, 2.5–4 mm long, obtuse to rounded. *Inflorescences* terminal, capitate with heads several and fasciculate, erect, glabrous, white to cream or pale yellow sometimes becoming pink to purplish with age; peduncles 3 or rarely 5, 1–4 cm long, each terminating in 1 head or sometimes a pair of bracts and 3 axes, these axes to 2 cm long and each terminating in 1 head, the basalmost bracts ovate, 1–3 cm long, acute to acuminate; heads 1–2 cm diam., ovoid to cupuliform, enclosed by 4 involucral bracts in 2 decussate pairs, these involucral bracts lanceolate to ovate, 1–2.5 cm long, acute to acuminate; floral bracts lanceolate to triangular, ligulate, or oblanceolate, 6–10 mm long, acute. *Flowers* sessile, distylous; hypanthium cylindrical, ca. 1 mm long, glabrous; *calyx* limb ca. 1 mm long, glabrous, sinuate to denticulate; *corolla* tubular to tubular-infundibuliform, white to usually pink or lavender, externally glabrous, internally glabrous except with a densely hirtellous ring near middle of tube, tube ca. 12 mm long, lobes 5, narrowly triangular, ca. 4.5 mm long, acute, abaxially smooth; *anthers* ca. 3 mm long, in long-styled form included, situated near middle of corolla tube, in short-styled form exserted; *stigmas* in long-styled form ca. 0.8 mm long and exserted, in short-styled form ca. 1.5 mm long, included, situated near middle of corolla tube, above its hirtellous ring. *Infructescences* purple; *fruits* obovoid, ca. 7 × 4 mm, glabrous, deep blue to purple-black; *pyrenes* 2, in cross section hemispherical, dorsally with 4 to 5 low rounded longitudinal ridges.

Habitat, distribution, and phenology. In premontane and cloud forests of central and western Panama at 600–1300 m; collected in flower January through June, September, and December, in fruit May through August and October.

This species has previously been confused with *Psychotria dichroa* (Standley) C. M. Taylor by Dwyer (1980). However, these two species are apparently allopatric and differ in several morphological features. Notably, in *P. paradichroa* the inflo-

rescences are white to cream or pale yellow (sometimes becoming pink to purple with age) and sessile or fasciculate with peduncles 1–4 cm long and the bracts acute to acuminate, versus in *P. dichroa* respectively always purple to rose, violet, or magenta, with solitary, entire or tripartite heads borne on peduncles 3–9 cm long, with the bracts shortly acuminate to usually obtuse. The type specimen of *P. dichroa* is so far known only from the Chiriquí Highlands of western Panama, while *P. paradichroa* comprises the specimens that have been included under this name from east of that region. Specimens of *P. paradichroa* are far more numerous than those of *P. dichroa*.

Paratypes. PANAMA. **Coclé:** sawmill 7 km NE of El Copé, *T. Antonio 1139* (MO); vicinity of La Mesa, N of el Valle de Antón, along E edge of Cerro Gaital, *T. Croat 67268* (MO); Alto Calvario above El Copé, ca. 6 km N of El Copé, *T. Croat 68751* (MO); Cerro Caracoral, *J. Duke & Dwyer 15103* (MO), *J. H. Kirkbride 1105* (MO); around Rivera sawmill, Alto Calvario, 7 km N of El Copé, *J. Folsom 3231* (MO), *J. Folsom et al. 5734* (MO); 3-mountain ridge above El Valle, *C. Hamilton et al. 4153* (MO); N of Penonomé, between Llano Grande and Cascajal, Continental Divide on road to Coclesito, *B. Hammel 7220* (MO); near sawmill 8 km N of El Copé (28 km NW of Penonomé), *P. Maas et al. 2772* (MO); Divide SW of La Mesa, *B. Stein & Hamilton 1001* (MO); above El Potroso sawmill at Continental Divide, *K. Sytsma 1857* (MO); from summit of Cerro Caracoral to summit of Cerro Gaital, N rim of El Valle, *K. Sytsma 3813* (MO); past Llano Grande on road to Cascajal, *K. Sytsma et al. 4377* (MO). **Panamá:** vicinity of Cerro Jefe NE of Cerro Azul, N of Interamerican Hwy., 12 mi. NE of Panama City, *T. Antonio 4719* (MO), *L. Carrasquilla 2086* (MO), *2131* (MO), *W. D'Arcy 11381* (MO), *W. D'Arcy et al. 15501* (MO), *W. D'Arcy & McPherson 16053* (MO), *R. Dressler 3317* (MO), *J. Duke 8018* (MO), *J. Folsom et al. 1854* (MO), *2012* (MO), *2504* (MO), *2514* (MO), *J. Folsom & Kearns 2731* (MO), *J. Folsom 3614* (MO), *C. Galdames & Montenegro 1402* (MO), *A. Gentry & Dwyer 3509* (MO), *A. Gentry & Mori 13433* (MO), *N. Hensold 1001* (MO), *C. Hamilton & D'Arcy 612* (MO), *B. Hammel 4417* (MO), *4420* (MO), *S. Knapp 913* (MO), *1208* (MO), *2239* (MO), *3521* (MO), *S. Knapp & Mallet 5201* (MO), *J. McDonagh et al. 46* (MO), *G. McPherson 6869* (MO), *10620* (MO), *S. Mori & Kallunki 3632* (MO), *6504* (MO), *S. Mori 6534* (MO), *K. Sytsma 1451* (MO), *E. Tyson et al. 3189* (MO), *3205* (MO), *3288* (MO), *3289* (MO), *3546* (MO), *3588* (MO), *4347* (MO), *4408* (MO), *R. Wilbur & Weaver 11094* (MO), *13612* (MO), *J. Witherspoon et al. 8282* (MO), *J. Witherspoon & Witherspoon 8503* (MO), *I. Valdespino et al. 681* (MO); area of Cerro Jefe near Altos de Pacora, *W. D'Arcy & Sytsma 14753* (MO). **Veraguas:** Cerro Tote [sic; probably Tute], *T. Antonio 1874* (MO); vicinity of Escuela Agricultura Alto Piedra near Santa Fé, along trail to top of Cerro Tute, *T. Antonio 1980* (MO), *2949* (MO), *C. Hamilton & Krager 4018* (MO), *S. Knapp & Sytsma 2650* (MO), *K. Sytsma & Andersson 4714* (MO); dist. Santa Fé, Serranía de Tute, *J. Aranda et al. 2697* (MO); 6.4 km outside of Santa Fé on road that passes the agriculture school, *J. Folsom 2974* (MO); shoulder of Cerro Tuti [sic; probably Tute], *J. Folsom et al. 3351* (MO); mountains W of Alto de Piedras W of Santa Fé, *B. Hammel 4617* (MO). **San Blas:** Cerro Brewster, *G. de Nevers et al. 5552* (MO).

Psychotria sanblasensis C. M. Taylor, sp. nov. TYPE: Panama. Comarca de San Blas: Pueblo de Playón Chico, Río Ukupseni, caminando 5 km río arriba después del campamento Ilagandi, 9°15′N, 78°15′W, 50–150 m, 7 Nov. 1991, *H. Herrera, J. Mojica & J. Morris 1100* (holotype, PMA; isotype, MO-4637909). Figure 1H–J.

Haec species a *Psychotria croceovenosa, P. paniculata* et *P. longirostri* lobulis stipularibus 1–1.2 mm longis, inflorescentiae grandis late pyramidalis axe glabro glabrescenteve, calycis limbo 0.2–0.5 mm longo, corollae tubo 4–5 mm longo lobulis exappendiculatis atque fructu ca. 4 × 5 mm distinguitur.

Shrubs or small trees flowering at 1.5 m tall, to 5 m tall; stems glabrous. *Leaves* elliptic to elliptic-oblong, 7.5–25 × 3.5–12 cm, at apex acute to somewhat acuminate, at base cuneate to obtuse or rounded, drying subcoriaceous, adaxially glabrous, abaxially glabrous or puberulous on costa; secondary veins 8 to 11 pairs, looping broadly to interconnect at least in apical portion of blade, without domatia, adaxially venation plane or sometimes costa thickened, abaxially costa prominent, secondary veins prominulous, and remaining venation plane to thickened; petioles 0.6–2.8 cm long; *stipules* interpetiolar or sometimes shortly united intrapetiolarly, glabrous to sparsely puberulous, oblong to broadly triangular, 3–4 mm long, bilobed for ¼–⅓, lobes ca. 1 mm long, triangular to broadly so, obtuse to rounded. *Inflorescences* terminal, paniculate, glabrous to moderately puberulous, apparently green; peduncles 4.5–12 cm long, frequently deflexed at base; branched portion pyramidal to broadly so, 9–30 × 8–30 cm, secondary axes 6 to 9 pairs, branched to several orders, thyrsiform; bracts triangular to narrowly so, those subtending secondary axes 2–5 mm long, those subtending flowers 0.2–1 mm long; *flowers* distylous, sessile or subsessile in dichasial cymules of 5 to 9, terminal flowers solitary and remaining flowers in groups of 2 to 3; hypanthium ca. 0.5 mm long, turbinate to cylindrical, puberulous; *calyx* limbs 0.2–0.5 mm long, puberulous, lobed for ⅓–⅔, lobes deltoid; *corolla* broadly funnelform, yellow to white, externally glabrous, internally glabrous except puberulous to hirtellous in basal ⅓ of tube, tube 4–5 mm long, lobes triangular, ca. 2 mm long, abaxially smooth; *anthers* in short-styled form ca. 3 mm long, included, situated near middle of corolla tube, in long-styled form ca. 1.5 mm long, included, situated ca. ⅓ of length of corolla tube above its base; *stigmas*

2, narrowly oblong to linear, in short-styled form 1.2–1.5 mm long, included, situated ca. ⅓ of length of corolla tube above its base, in long-styled form ca. 1 mm long, exserted. *Infructescences* similar to inflorescences except becoming pendulous and apparently purple; *fruits* ellipsoid, ca. 4 × 5 mm, laterally somewhat flattened, black to purple or blue, glabrescent; *pyrenes* 2, planoconvex, dorsally with 3 to 4 longitudinal, obtuse ridges or angles.

Habitat, distribution, and phenology. In wet forests at 50–850 m, east-central Panama; collected in flower in April and September through November, in fruit April through July and September through October.

This new species appears to be endemic to east-central Panama, in particular to the phytogeographically distinctive San Blas region; the specific epithet refers to this last region. *Psychotria sanblasensis* is characterized by its unusually large, lax inflorescences, but is similar in its general aspect and various details to several other *Psychotria* species found in Panama with which it has been confused. *Psychotria croceovenosa* Dwyer differs from this new species by its smaller fruits, 3.5–4 mm in diameter, and its densely puberulous to pilosulous inflorescence axes; *P. longirostris* (Rusby) Standley differs from this new species by its stipules that are only shallowly emarginate, and its corollas with tubes 5.5–7 mm long and lobes with linear abaxial appendages ca. 0.3 mm long; *P. paniculata* (Aublet) Raeuschel differs from this new species by its stipule lobes 2.5–4 mm long, narrower cylindrical inflorescences 4–7 cm wide, and pyrenes with the surfaces finely pitted; and *P. angustiflora* K. Krause differs from this new species by its corollas with tubes 5.5–6 mm long.

Paratypes. PANAMA. **Colón:** Santa Rita ridge, 19 km from paved highway, *J. Dwyer 8574* (MO); along Río Guanche, 3–7 km above bridge, *B. Hammel et al. 4886* (MO); upper Río Piedras headwaters, along trail from end of Santa Rita Ridge Road, ca. 11 km SW of Cerro Braja, *K. Sytsma et al. 4235* (MO; diseased), *K. Sytsma et al. 4267* (MO). **Panamá:** on road near slopes of Cerro Jefe, *T. Antonio et al. 3425* (MO); road past Altos de Pacora, 3–3.5 mi. NE of Altos de Pacora, 7.8–8.2 mi. above PanAm Highway, 11.1–11.6 m beyond lago Cerro Azul, *T. Croat 68674* (MO); Cerro Jefe, *J. Duke 9401* (MO); Cerro Jefe, summit, *J. Dwyer et al. s.n.* [12 Mar. 1967] (MO-1946867); Cerro Jefe, *J. Dwyer & Gauger 7368* (MO), *J. Dwyer & Gentry 9469* (MO); headwaters of Río Chagres, Río Esperanza and Río Piedras, *G. de Nevers et al. 4067* (MO); Cerro Jefe region, along road to Alto de Pacora, 2 km N of turnoff to Cerro Jefe radio tower, *B. Hammel 4855* (MO); vertiente pacífica de la Cordillera de San Blas, cabecera del Río Piriadi, *H. Herrera 1632* (MO). **Panamá–San Blas border:** road from El Llano to Cartí, 13.9 km N of Panamerican Highway, *J. Folsom et al. 6177* (MO). **San Blas:** El Llano–Cartí road, vicinity of Nusagandí, sendero Nusagandí down to Atlantic coast, *T. Croat 69273* (MO); El Llano–Cartí road, 18 km from Panamerican Hwy., *G. de Nevers 4123* (MO); Cerro Brewster, *G. de Nevers et al. 5565* (MO); trail from Río Esadi to Cerro Banega, *G. de Nevers & Herrera 6636* (MO); Yar Bired (cerro San José), Continental Divide between Cangandi and San José, *G. de Nevers & Herrera 6915* (MO); trail to Cerro Obu (Habu of maps) from Río Urgandi (Río Sidra), *G. de Nevers et al. 7973* (MO); on trail to Darién from Puerto Obaldía, 15–20 km WSW of Puerto Obaldía on Caribbean slope, *S. Mori et al. 6852* (MO); Nusagandi, sede de campo de Pemasky, ca. 20 km on El Llano–Cartí road, *R. Paredes et al. 806* (MO).

Psychotria simiarum Standley subsp. **chiapensis** C. M. Taylor, subsp. nov. TYPE: Mexico. Chiapas: Palenque, vicinity of the Palenque archeological site, 170 m, 11 May 1982, *G. Davidse, M. Sousa, A. Chater & E. Cabrera 20351* (holotype, MEXU; isotype, MO-2937631). Figure 1A, B.

Haec subspecies a subspecie typica inflorescentia foliis fructuque majoribus atque distributione geographica ut videtur allopatrica distinguitur.

Trees to 15 m tall, branched; stems glabrous. *Leaves* elliptic-obovate to elliptic-oblanceolate, elliptic, or elliptic-oblong, 7.5–18.5 × 2.5–8 cm, at apex acute to somewhat acuminate, at base acute to cuneate, drying papyraceous, on both surfaces glabrous; secondary veins 8 to 12 pairs, not or weakly looping to interconnect, without domatia, adaxially venation plane, abaxially costa prominent, secondary veins prominulous, and remaining venation plane; petioles 1–4 cm long; *stipules* persistent, glabrous, interpetiolar to shortly united around stem, ovate to triangular, 2–4 mm long, shortly bidentate with teeth 2 per side, 0.3–0.8 mm long, narrowly triangular. *Inflorescences* terminal, paniculate, glabrous to papillose-puberulous, perhaps pale green; peduncles 5–9 cm long; branched portion rounded-corymbiform, 4–6.5 × 6–8 cm, with secondary axes produced at 2 to 4 nodes, 4 per node or 2 per node and then congested to subverticillate, terminating in 7- to 15-flowered dichasial cymes; bracts acute, those subtending secondary axes narrowly triangular, 1–4 mm long, those subtending flowers linear, 0.2–1.2 mm long; *flowers* sessile and subsessile in congested cymules; hypanthium cylindrical, ca. 0.5 mm long, glabrous; *calyx limb* 0.8–1 mm long, glabrous, sinuate to shallowly dentate; *corolla* funnelform, white, externally glabrous, internally glabrous except with a hirtellous ring just above middle of tube, tube ca. 4 mm long, lobes 5, narrowly triangular, ca. 2 mm long, abaxially smooth; *anthers* in apparent long-styled form ca. 1.2 mm long, included, situated just below corolla throat; *stigmas* in apparent long-

styled form ca. 0.3 mm long, exserted. *Infructescences* similar to inflorescences or to 10 cm wide, with axes more spreading; *fruits* ovoid to subglobose, 7–8 × 6–7 mm, glabrous, blue; *pyrenes* 2, planoconvex, dorsally smooth.

Habitat, distribution, and phenology. In wet forests at 120–1700 m, central and southern Mexico (Chiapas, Veracruz); collected in flower in May, in fruit February and September through December.

This new subspecies appears to be allopatric with regard to the typical subspecies; the specific epithet refers (in part) to its geographic distribution. *Psychotria simiarum* subsp. *simiarum* is found from Belize through Panama (the type is from Honduras) and also in coastal Veracruz, and differs from this new subspecies in its somewhat smaller leaves 6–15 × 2.5–6 cm, smaller inflorescences with the branched portion 2–4 × 2–5 cm, and smaller fruits ca. 6 mm in diameter. Otherwise these plants cannot be distinguished and thus the northern group is here recognized as a subspecies. There does appear on herbarium specimens to be some difference in lengths of anthers and stigmas between the subspecies, but few well preserved flowers are available of Mexican *P. simiarum*.

Paratypes. MEXICO. **Chiapas:** mpio. Berriozábal, 13 km N of Berriozábal, *D. Breedlove & Smith 21646* (MO, NY); mpio. Palenque, along ridges 6–12 km S of Palenque on road to Ocosingo, *D. Breedlove 28793* (MO); mpio. Peltalcingo, slope of Ahk'ulbal Nab above Petalcingo, *D. Breedlove 49894* (MO); a 8 km al O de Palenque, cerca de la cascada Motiepa, *E. Cabrera & H. de Cabrera 3949* (MO); en los alrededores de la zona arqueológica de Palenque, *E. Cabrera & H. de Cabrera 7017* (MO); mpio. Ocosingo, Centro Arqueológico Bonampak, *J. Meave et al. B-507* (MO). **Veracruz:** mpio. Minatitlán, 13.7 km al E de La Laguna sobre terracería a Uxpanapa, luego 7.1 km al N sobre camino nuevo a Belisario Domínguez, *T. Wendt et al. 3484* (MO); 6.5 km al N, *T. Wendt et al. 5474* (MO); mpio. Hidalgotitlán, Peñasco al NE de La Laguna, al E del Río Cuevas y la Estación de Luz, *T. Wendt et al. 6077* (MO).

Psychotria sinuata C. M. Taylor, sp. nov. TYPE: Colombia. Valle del Cauca: mpio. Buenaventura, campamento El Chanco, Proyecto Calima III CVC, 4°00′N, 76°00′N, 450 m, 15 Mar. 1986, *W. Devia 1190* (holotype, TULV; isotype, MO). Figure 1F, G.

Haec species a congeneris *Psychotria* subgeneris *Heteropsychotriae* foliorum nervis secundariis in nervum sinuatum submarginalem manifestum conjunctis marginibus ad eum plerumque parallelis sinuatisque atque inflorescencia laxa sat ampla distinguitur.

Shrubs flowering at 2 m tall, to 4 m tall; stems puberulous to glabrescent. *Leaves* elliptic, 14–28 × 4.5–13 cm, at apex acute to usually acuminate with tips to 12 mm long, at base obtuse to cuneate, drying papyraceous, adaxially glabrous, abaxially puberulous to glabrescent; secondary veins 13 to 18 pairs, uniting in a well-developed undulating submarginal vein, without domatia, adaxially and abaxially costa prominulous to prominent, secondary veins prominulous, and remaining venation thickened to prominulous, subparallel and perpendicular to secondary veins; margins thickened, plane, often sinuate or scalloped in outline parallel to submarginal veins; petioles 12–20 mm long; *stipules* persistent, puberulous to glabrous, united around stem, sheath 3–6 mm long, truncate, lobes 2 per side, narrowly triangular to deltoid, 2–4 mm long, acute. *Inflorescences* terminal, paniculate, puberulous to glabrous or sometimes hirtellous in lines or patches, green, perhaps strongly deflexed; peduncles 9–14 cm long; branched portion 12–21 × 16–28 cm, pyramidal; primary axis often flexuous; secondary axes 6 to 7 pairs, branched to several orders; bracts narrowly triangular, acute, those subtending secondary axes 4–11 mm long, those subtending flowers 0.8–1.2 mm long; *flowers* apparently distylous, sessile in dichasial cymules of 5 to 15; hypanthium turbinate, ca. 0.5 mm long, glabrous; *calyx* limb ca. 0.3 mm long, glabrous, deeply lobed, lobes triangular to deltoid, obtuse; *corolla* tubular-funnelform, white, externally puberulous, internally glabrous except hirtellous at and above stamen insertion, tube 3.5–4 mm long, 0.8–1 mm diam. near middle, lobes 5, triangular, 1.2–1.5 mm long, acute, adaxially a little thickened; *anthers* in apparent short-styled form ca. 1.2 mm long, partially exserted; *stigmas* in apparent long-styled form ca. 0.2 mm long, exserted. *Infructescences* similar to inflorescences or with axes more spreading; *fruits* ellipsoid to ovoid, ca. 4 × 4.5 mm, glabrous, blue-black; *pyrenes* 2, planoconvex, dorsally with 3 to 5 weak acute ridges.

Distribution, habitat, and phenology. In wet forests at 130–700 m, western Colombia to northwestern Ecuador; collected in flower in February, March, and October, in fruit in October.

This new species is distinguished by its leaves with the secondary veins united in a well-developed submarginal vein and the margins usually sinuate to scalloped in parallel to this submarginal vein; the epithet refers to this margin shape, which is not known in other species of *Psychotria* subg. *Heteropsychotria*. The inflorescences are usually relatively large and weak to deflexed or even pendulous. Similarly well-developed, lax inflorescences

are found in *P. angustiflora* K. Krause of southern Central America; *P. angustiflora* differs from this new species in its straight leaf margins and interpetiolar, shallowly lobed stipules. This new species is also similar to *P. ramiflora* Rusby of Amazonian South America; *P. ramiflora* differs in its straight leaf margins and pedicellate flowers. The higher order leaf venation of this new species often has a characteristic, very regular organization, which is similar in general appearance to that seen in some species of *Compsoneura* Warburg (Myristicaceae).

Paratypes. COLOMBIA. **Chocó:** along road between Pueblo Rico (Risaralda) and Istmina (Chocó), along Quebrada Antón, 15 km W of Santa Cecilia, 6 km W of Chocó-Risaralda border, ca. 20 km E of Playa del Oro, *T. Croat 70897* (MO); mpio. San José del Palmar, hoya del Río Torito (afluente del Río Hábita), declive occidental, finca "los Guaduales," quebrada Santa Fe, afluente del Río Torito, *E. Forero et al. 6782* (MO). **Valle del Cauca:** mpio. Buenaventura, correg. Córdoba, vereda San Cipriano, Reserva Natural Río Escalerete, in permanent plot, 3°50′N, 76°52′W, *W. Devia 5644* (MO, TULV), *C. M. Taylor et al. 11975* (COL, JAUM, MO, TULV), *11983* (COL, JAUM, MO, TULV). ECUADOR. **Carchi:** trail through forest near San Marcos 45 km W of Chical, *W. Hoover 1064* (MO).

Psychotria soejartoi C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: mpio. de Anorí, correg. de Providencia, Valle del Río Anorí, entre Dos Bocas y Anorí, zona transicional entre bosque húmedo y bosque montañoso, Buenos Aires, primary forest trail, above bridge between Providencia and Anorí, ca. 4 km upriver, 400–900 m, 6–12 Sep. 1973, *D. D. Soejarto, R. Fonnegra, P. Havens & J. White 4318* (holotype, MO-4030419; isotypes, F-1809850, HUA). Figure 3A.

Haec species a *Psychotria stenostachya* pyrenis duabus, floribus in glomerulos plerumque inflorescentiae ad axem primarium sessiles dispositis atque lobulis corollinis abaxialiter exappendiculatis distinguitur.

Shrubs or small trees to 4 m tall, branched, erect; stems glabrous. *Leaves* elliptic, elliptic-oblong, or elliptic-oblanceolate, 10–23 × 3.8–10 cm, at apex acute to usually rather abruptly acuminate with the acumen 8–15 mm long, at base acute to obtuse, drying chartaceous, on both surfaces glabrous; secondary veins 8 to 13 pairs, usually extending at least weakly to margins, without domatia, adaxially venation plane or costa a little sulcate, abaxially costa prominent, secondary veins prominulous, and remaining venation plane to a little thickened; petioles 0.8–3.2 cm long; *stipules* persistent, glabrous, united around stem, externally glabrous, internally glabrous except with a ring of colleters 1.5–3 mm long at junction of sheath and stem, sheath 1–4 mm long, lobes 2 per side, 5–18 mm long, deeply 2- to 4-fid (so the stipules apparently 4- to 8-lobed on each side) with segments narrowly triangular, unequal in length, acute to acuminate, often caducous by fragmentation. *Inflorescences* terminal, spiciform, congested-cymose, puberulous to glabrous; peduncles 2–12 mm long; flowering portion cylindrical, 3–3.5 × 2 cm, with 5 to 14 glomerules of flowers, these sessile or subsessile on primary axis, subopposite to alternate; bracts triangular to ligulate, 2–6 mm long, obtuse to acute; *flowers* sessile in glomerules of 3 to 5; hypanthium turbinate, ca. 1 mm long, glabrous; *calyx* limb 0.8–1 mm long, glabrous, truncate to sinuate; *corolla* funnelform, white, externally glabrous, internally glabrous except hirtellous in upper half of tube, tube ca. 4 mm long, lobes 5, ligulate, ca. 4 mm long, obtuse, abaxially smooth; *anthers* ca. 1.5 mm long, exserted on filaments ca. 3.5 mm long, these inserted just above middle of corolla tube; *stigmas* ca. 1 mm long, included, situated near middle of corolla tube. *Infructescences* similar to inflorescences or to 6.5 × 2.5 cm, usually becoming more elongated and occasionally with secondary axes also developing; *fruits* ellipsoid to obovoid, 5–5.5 × 6–7 mm, laterally somewhat flattened, glabrous, mature color unknown; *pyrenes* 2, planoconvex, dorsally with 4 to 5 obtuse ridges.

Habitat, distribution, and phenology. In wet forests at 330–900 m in northwestern Colombia and perhaps eastern Panama (see discussion below); collected in flower in April and May, in fruit August through October.

This new species has previously been confused *in herb.* with *Psychotria stenostachya* Standley, which it resembles generally in aspect, stipule morphology, and inflorescence arrangement. However, *P. stenostachya* differs in having usually clearly developed secondary inflorescence axes, undivided or only very shortly fimbriate stipule lobes (the stipules thus appearing 2-lobed on each side), calyx limbs that are deeply lobed, and corolla lobes ca. 2 mm long with a linear abaxial appendage 0.5–1.2 mm long. This new species has been collected by several botanists but was first documented by the specimens of D. D. Soejarto, who established the herbarium at the University of Antioquia, Colombia (HUA), and the specific epithet commemorates him. The few flowers seen resemble the short-styled form of distylous species. The fruits are said by some collectors to be orange, but the same is said of several other *Psychotria* species in which

the fruits are actually black at maturity, but rarely seen.

The collection *S. Knapp & Mallet 4660* (Panama, San Blas, trail from Puerto Obaldía to La Bonga, tributary of Río Armila, ca. 2 hrs. walk from Puerto Obaldía, 0–50 m, MO) is similar vegetatively, in inflorescence size and details, and in calyx morphology, and this specimen is provisionally included in this new species as the only Panamanian collection. However, this collection differs from the Colombian specimens in its corollas in bud with tubes already ca. 9 mm long, and it may represent a related but distinct species; the material available at present is inadequate to evaluate its status.

Paratypes. COLOMBIA. **Antioquia:** mpio. San Luis, Parque Ecológico Cañón del Río Claro, sector central, margen izquierda, *A. Cogollo & Borfa 739* (JAUM, MO), *A. Cogollo 864* (JAUM, MO); mpio. Anorí, correg. Providencia, valle del Río Anorí, entre Dos Bocas y Anorí, Buenos Aires, 4 km from Providencia, *D. Soejarto et al. 3947* (F, MO); vicinity of Planta Providencia, ca. 35 km SW of Zaragoza, in valley of Río Anorí in areas surrounding confluence of Quebrada La Tirana and Río Anorí, *R. Waide 62413* (US). **Chocó:** carretera San José del Palmar-Nóvita, alrededores del campamento de Curundó, ca. de Río Ingará, *E. Forero et al. 2337* (MO).

Acknowledgments. I thank R. E. Gereau for preparation of the Latin diagnoses; the curators of CHOCO, CR, F, HUA, PMA, TULV, and US for access to specimens; the National Geographic Foundation for support for fieldwork in Colombia; R. Foster, T. Wachter, and the Andrew Mellon Foundation through a grant to the Field Museum of Natural History for support for travel to that institution; M. Correa and F. Piesschaert for providing helpful information; and my good colleague W. Devia for providing information and invaluable collaboration.

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Appendix 1

Additional specimens studied of *Psychotria buchtienii* (H. Winkler) Standley, arranged by country, then alphabetically. Countries are arranged north to south.

MEXICO: *D. Breedlove 56631* (MO); *D. Breedlove & Almeda 57604* (MO); *E. Martínez S. 13500* (MO), *13509* (MO), *15887* (MO), *18283* (MO), *18284* (MO).

GUATEMALA: *E. Contreras 9946* (MO), *9949* (MO), *10213* (MO), *10308* (MO), *10317* (MO), *11400* (MO); *W. Harmon & Fuentes 2064* (MO); *W. Kellerman 7370* (US); *C. Lundell & Contreras 19488* (MO); *E. Martínez S. & Stevens 23323* (MO); *E. Martínez S. et al. 13672* (MO); *H. von Tuerckheim 4140* (US).

HONDURAS: *D. Aguilar 165* (MO); *C. Garcés 189* (MO); *I. Montoya 146* (MO); *C. Morton 7789* (US); *C. Nelson & Escobar 8581* (MO); *V. L. Ochoa 118* (MO); *O. Téllez V. & Martínez 8443* (MO).

NICARAGUA: *A. Grijalva 447* (MO); *J. Pipoly 6128* (MO).

COSTA RICA: *D. Acevedo 67* (MO); *R. Aguilar 2163* (MO); *W. Alverson & Flores 3112* (MO); *J. Beach 1320* (MO), *1355* (MO), *1360* (MO); *G. Carballo 187* (MO); *E. Castro 293* (MO); *I. A. Chacón G. 529* (MO); *G. Cordero 17* (MO), *57* (MO); *E. Cowan 4587* (MO); *T. Croat 36641* (MO), *36740* (MO), *43423* (MO); *T. Croat & Grayum 59700* (MO), *59704* (MO), *59885* (MO); *T. Croat 67674* (MO); *C. Dodge & Thomas 4401* (MO); *J. Folsom 8742* (MO), *9252* (MO), *9333* (MO), *9510* (MO), *9521* (MO); *G.*

Frankie 194 (MO); *N. Garwood et al. 1146* (MO); *R. Godfrey 66581* (MO); *L. D. Gómez P. 19435* (MO); *R. González 14* (MO); *L. Gutiérrez et al. 9* (MO); *B. Hammel 7748* (MO), *11160* (MO), *11261* (MO), *11736* (MO), *11837* (MO), *12087* (MO), *12352* (MO); *B. Hammel et al. 19391* (MO); *G. Herrera 3204* (MO); *W. Huber & Weissenhofer 10* (MO), *9918-4* (MO); *G. Induni 153* (MO), *207* (MO, but probably wrong label); *A. Jiménez M. 3691* (MO); *C. Kernan 173* (MO); *R. Lent 454* (MO); *R. Liesner 1797* (MO), *3265* (MO), *14313* (MO); *S. Martén 876* (MO); *T. McDowell & Santana 297* (MO), *299* (MO); *T. McDowell 643* (MO); *J. Morales 3187* (MO); *R. Rueda et al. 1392* (MO); *J. Solomon 19253* (MO); *J. Sperry 605* (MO); *C. M. Taylor & Gereau 9804* (MO); *O. Valverde & Estrada 167* (MO); *S. Will 12/02/99/13* (MO), *25/07/99/69* (MO); *L. O. Williams et al. 24242* (MO).

PANAMA: *T. Antonio 3104* (MO); *J. Aranda 2862* (MO); *T. Beliz et al. 3770* (MO), *3845* (MO); *T. Croat 13328* (MO), *22650* (MO), *22921* (MO), *23013* (MO), *25946* (MO), *25675* (MO), *27292A* (MO), *27457* (MO), *27638* (MO), *27640* (MO); *T. Croat & Folsom 34044* (MO); *T. Croat 37686* (MO), *37703* (MO), *37725* (MO); *H. Cuadros et al. 3851* (MO); *G. Davidse & Hamilton 23704* (MO); *G. de Nevers et al. 8422* (MO); *J. Duke 4056* (MO), *8748* (MO), *13155* (MO), *13523* (MO); *J. Duke & Lallathin 15001* (MO); *J. Dwyer 2223* (MO), *2251* (MO); *J. Dwyer et al. 3461* (MO), *3497* (MO), *4534* (MO); *J. Dwyer 8311* (MO), *8346* (MO); *J. Dwyer & Lallathin 8606* (MO), *8620* (MO); *J. Dwyer 8895* (MO); *J. Dwyer & Correa 8904* (MO); *8943* (MO); *J. Dwyer & Gentry 9431* (MO); *J. Dwyer 10520* (MO), *11907* (MO); *J. Folsom & Lantz 1882* (MO); *J. Folsom et al. 1983* (MO); *J. Folsom & Robinson 2348* (MO); *J. Folsom 4252* (MO); *J. Folsom et al. 5016* (MO); *J. Folsom 5915* (MO); *J. Folsom et al. 6268* (MO), *6631* (MO), *6746* (MO), *6990* (MO); *C. Galdames et al. 2498* (MO); *A. Gentry et al. 3428* (MO), *3429* (MO); *A. Gentry & Dwyer 3636* (MO); *A. Gentry 6852* (MO); *A. Gentry & Mori 13843* (MO); *A. Gentry et al. 28708* (MO); *W. Hahn 145* (MO), *231* (MO), *262* (MO), *284* (MO); *C. Hamilton & D'Arcy 669* (MO); *C. Hamilton & Davidse 2616* (MO), *2774* (MO), *2775* (MO); *C. Hamilton & Dressler 3018* (MO); *B. Hammel 951* (MO), *1050* (MO), *1680* (MO), *1825* (MO), *4344* (MO), *4789* (MO); *B. Hammel et al. 16182* (MO); *Sr. M. V. Hayden 1005* (MO); *H. Kennedy et al. 2084* (MO); *J. H. Kirkbride & Duke 504* (MO), *580* (MO), *665* (MO), *1338* (MO); *S. Knapp & Mallet 3060* (MO), *3107* (MO), *3132* (MO); *S. Knapp et al. 4556* (MO); *W. Lewis et al. 1907* (MO), *2144* (MO), *2147* (MO); *J. McDonagh et al. 598* (MO); *G. McPherson 10292* (MO); *S. Mori & Kallunki 2189* (MO), *5396* (MO); *M. Nee & Dwyer 9216* (MO); *M. Nee 9306* (MO); *M. Nee & Hale 9619* (MO); *M. Nee 9712* (MO); *D. Porter et al. 4397* (MO), *4415* (MO), *4474* (MO); *D. Santamaría et al. 747* (MO); *D. Santamaría & Lara 1007* (MO); *B. Stein & Hamilton 1138* (MO), *1152* (MO); *G. Sullivan 655* (MO); *K. Sytsma et al. 2880* (MO), *2898* (MO); *K. Sytsma & D'Arcy 3233* (MO), *3256* (MO), *3286* (MO), *3361* (MO), *3448* (MO); *K. Sytsma 3748* (MO); *K. Sytsma & Andersson 4560* (MO); *M. Terry & Terry 1488* (MO); *E. Tyson et al. 3320* (MO); *H. von Wedel 1422* (MO), *1608* (MO), *1638* (MO), *2196A* (MO); *C. Whitefoord & Eddy 318* (MO); *R. Wilbur et al. 11339* (MO).

COLOMBIA: *J. Brand & Ascanio 318* (MO); *R. Callejas 4629* (MO); *W. Devia & Prado 2463* (MO); *W. Devia et al. 2904* (MO); *J. Duke 9604* (MO), *11062* (MO); *R. Fonnegra & Rengifo 4893* (MO); *E. Forero et al. 1821* (MO), *3095* (MO), *3536* (MO), *7534* (MO), *8838* (MO), *8840* (MO); *F. Fosberg & Cuatrecasas 27433* (MO); *P. Franco et al. 1288* (MO), *3523* (MO); *L. Garcia et al. 290* (MO); *A. Gentry & Mori 13699* (MO); *A. Gentry 35683* (MO); *D. Giraldo-Cañas 582* (MO); *A. Gómez et al. 684* (MO); *J. J. Hernández et al. 105* (MO), *154* (MO); *S. Hoyos & Hernández 966* (MO); *H. León 501* (MO); *J. MacDougal et al. 4195* (MO); *J. G. Ramírez & Cárdenas 316* (MO), *947* (MO), *1666* (MO); *J. F. Smith et al. 1403* (MO); *W. Thomas & Castaño 5479* (MO); *J. Zarucchi et al. 5053* (MO), *5068* (MO), *66431* (MO), *6643* (MO).

ECUADOR: *A. Alvarado 174* (MO), *230* (MO); *G. Argent 326* (MO); *J. Brandbyge & Asanza 31007* (AAU), *31011* (AAU), *31201* (AAU); *J. Brandbyge et al. 30187* (AAU); *H. Balslev et al. 97079* (AAU); *T. Croat 58595* (MO); *E. Freire & Cerda 380* (MO); *E. Freire et al. 2875* (MO); *A. Gentry 9763* (MO), *12449* (MO); *J. Valenzuela & Freire 457* (MO); *H. Varga & Grefa 930* (MO).

PERU: *T. Croat 19466* (MO); *C. Del Carpio 2167* (MO); *A. Gentry et al. 27410* (MO), *31417* (MO), *39712* (MO), *62002* (MO); *J. Jaramillo & Coello 4153* (AAU); *J. Jaramillo et al. 31176* (AAU); *R. Kayap 1381* (MO); *S. McDaniel 16241* (MO); *J. Pipoly et al. 12392* (MO), *12499* (MO), *12569* (MO); *J. Schunke V. 6652* (MO), *6719* (MO); *M. Timaná 1076* (MO); *R. Vásquez & Jaramillo 2701* (MO).

BOLIVIA: *O. Buchtien 295* (MO); *B. Krukoff 10958* (MO); *J. Solomon 9272* (MO), *9438* (MO), *9596* (MO).

Atriplex argentea var. *expansa* (Chenopodiaceae), a New Combination for the *Flora of North America*

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ABSTRACT. The name *Atriplex argentea* var. *mohavensis* is not correct when *A. expansa* is treated as a synonym. Publication of its basionym, *A. expansa* var. *mohavensis*, created the autonym, variety *expansa*, which has priority according to the *International Code of Botanical Nomenclature* (Art. 11.6). Thus, the combination *A. argentea* var. *expansa* is established to replace the name variety *mohavensis* used in volume 4 of the *Flora of North America*.

Key words: *Atriplex*, Chenopodiaceae, North America.

The name *Atriplex argentea* var. *mohavensis* (M. E. Jones) S. L. Welsh, adopted but not validly published by Taylor and Wilken (1993), was validly published by Welsh (2003) just prior to its inadvertent republication in the *Flora of North America* (Welsh, 2004a: 351). Two months later the name was proposed yet again (Welsh, 2004b), although it would not have been valid (Art. 33.3; Greuter et al., 2000) as the date of the basionym was not included in the protologue. In any case, the two later publications are isonyms and as such have no nomenclatural status (Art. 6, Note 1). The validly published name was not correct as Welsh (2003) cited *A. expansa* S. Watson in synonymy (not mentioned in the FNA volume because of their editorial style of limiting citation of synonyms). Inasmuch as the basionym, *A. expansa* S. Watson var. *mohavensis* M. E. Jones, automatically created the autonym, variety *expansa*, this epithet has priority (Art. 11.6; Greuter et al., 2000). *Atriplex argentea* var. *mohavensis*, while superfluous when published (Art. 52.1), is legitimate and may be used if *A. expansa* is excluded from synonymy. That not being the case according to Welsh (2003, 2004b), the following combination is required.

Atriplex argentea Nutt. var. **expansa** (S. Watson) S. L. Welsh & Reveal, comb. nov. Basionym: *Atriplex expansa* S. Watson, Proc. Amer. Acad. Arts 9: 116. 1874. *Atriplex argentea* subsp. *expansa* (S. Watson) H. M. Hall & Clements, Publ. Carnegie Inst. Wash. 326: 301. 1923. TYPE: U.S.A. New Mexico: "39. Chenop. sand bars in Rio Grande below Dona Ana, July 28, 1851," *C. Wright 574* (lectotype, designated by Welsh (2003: 26), GH).

Atriplex trinervata Jepson, Pittonia 2: 305. 1892. *Atriplex expansa* S. Watson var. *trinervata* (Jepson) J. F. Macbride, Contr. Gray Herb. 53: 9. 1918. TYPE: U.S.A. California: Solano Co., near the Araquipa Hills, 22 Sep. 1891, *W. L. Jepson s.n.* (holotype, JEPS; isotype, RSA).
The holotype is a single specimen mounted on three sheets (JEPS 2770–2772).

Atriplex expansa S. Watson var. *mohavensis* M. E. Jones, Contr. W. Bot. 11: 20. 1903. *Atriplex argentea* Nutt. var. *mohavensis* (M. E. Jones) S. L. Welsh, N. Amer. Sp. Atriplex: Addendum [p. 159]. 2003. TYPE: U.S.A. California: Kern Co., Mojave, 26 Aug. 1894, *M. E. Jones s.n.* (lectotype, designated by Welsh (2003: 26), POM).

Atriplex sordida Standley, N. Amer. Fl. 21: 47. 1916. TYPE: U.S.A. California: Riverside Co., San Jacinto Valley, 1880, *G. Vasey 549* (holotype, US).

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Thalictrum pseudoichangense (Ranunculaceae), a New Species from Guizhou, China

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ABSTRACT. *Thalictrum pseudoichangense* Q. E. Yang & G. Zhu, a new species of Ranunculaceae from Guizhou Province, China, is described and illustrated. The new species is related to *T. ichangense* Lecoyer ex Oliver and *T. coreanum* H. Léveillé by having peltate leaflets and stipitate achenes, but differs in the styles being much longer, ca. 3 mm long.

Key words: China, Ranunculaceae, *Thalictrum*.

In the course of examining specimens of Ranunculaceae in the herbarium of the Royal Botanic Gardens, Kew (K), a gathering of *Thalictrum* L. made in Guizhou, southwestern China, i.e., *H. J. Esquirol s.n.*, caught the first author's attention. This gathering had been previously identified as *T. fortunei* S. Moore at Kew, a species occurring only in eastern China's Ahhui, Jiangsu, Jiangxi, and Zhejiang Provinces. At first glance the specimen is somewhat similar to *T. fortunei* in habit and leaf shape, but upon careful examination it is clearly a quite different species. The plant under question has slightly peltate leaves and conspicuously stipitate achenes, whereas *T. fortunei* has non-peltate leaves and sessile achenes. Having peltate leaves and stipitate achenes, the plant is undoubtedly close to *T. ichangense*, a species widely distributed in China and northern Vietnam, and also to *T. coreanum* (sometimes treated as a variety of *T. ichangense*, i.e., var. *coreanum* (H. Léveillé) H. Léveillé ex Tamura), a species occurring in Korea, but differs by having styles much longer, ca. 3 mm long, subulate in shape, and ventrally indistinctly stigmatic. In both *T. ichangense* and *T. coreanum*, the achenes have very short and inconspicuous styles ca. 0.3 mm long and ventrally distinctly stigmatic. As the length of styles and the degree of development of stigmatic tissue are important characters for the classification of the genus *Thalictrum* (Wang & Wang, 1979; Wang, 1980), it seems reasonable to describe the plant as a new species.

The gathering *H. J. Esquirol s.n.* has no record of precise collection locality, date, or habitat. The record includes only "Kweichow, collected by *H. J. Esquirol.*" The sheet at Kew was presented to K in January 1950 by the Hong Kong Herbarium of the Agriculture, Fisheries and Conservation Department of Hong Kong, with the accession number to the Hong Kong Herbarium being 252. We expect to find more sheets of this gathering from the Hong Kong Herbarium.

H. J. Esquirol was a French missionary collecting plants mainly in Guizhou Province from 1896 to 1933, particularly in its southwestern part, such as Xingyi, Zhenfeng, Ceheng, and Wangmo Counties (W. T. Wang, unpublished data). We suspect the gathering *H. J. Esquirol s.n.* mentioned above might be made from southwestern Guizhou, although we could not find any other gatherings of the new species from this region after a comprehensive survey of *Thalictrum* collections deposited in the major Chinese herbaria. This is somewhat understandable since Guizhou is a province of China not yet very carefully botanized.

Thalictrum includes 150 to 200 species in the world, mainly distributed in temperate regions (Fu & Zhu, 2001; Tamura, 1995). In China 76 species have been recorded, of which 49 are endemic (Wang & Wang, 1979; Fu & Zhu, 2001). Most of the Chinese *Thalictrum* species are distributed in southwestern China, particularly in Yunnan and Sichuan. The genus is not richly represented in Guizhou, where only nine species (including the new species described herein) have been known. Detailed fieldwork is needed to gain a better knowledge of the genus *Thalictrum* in this province.

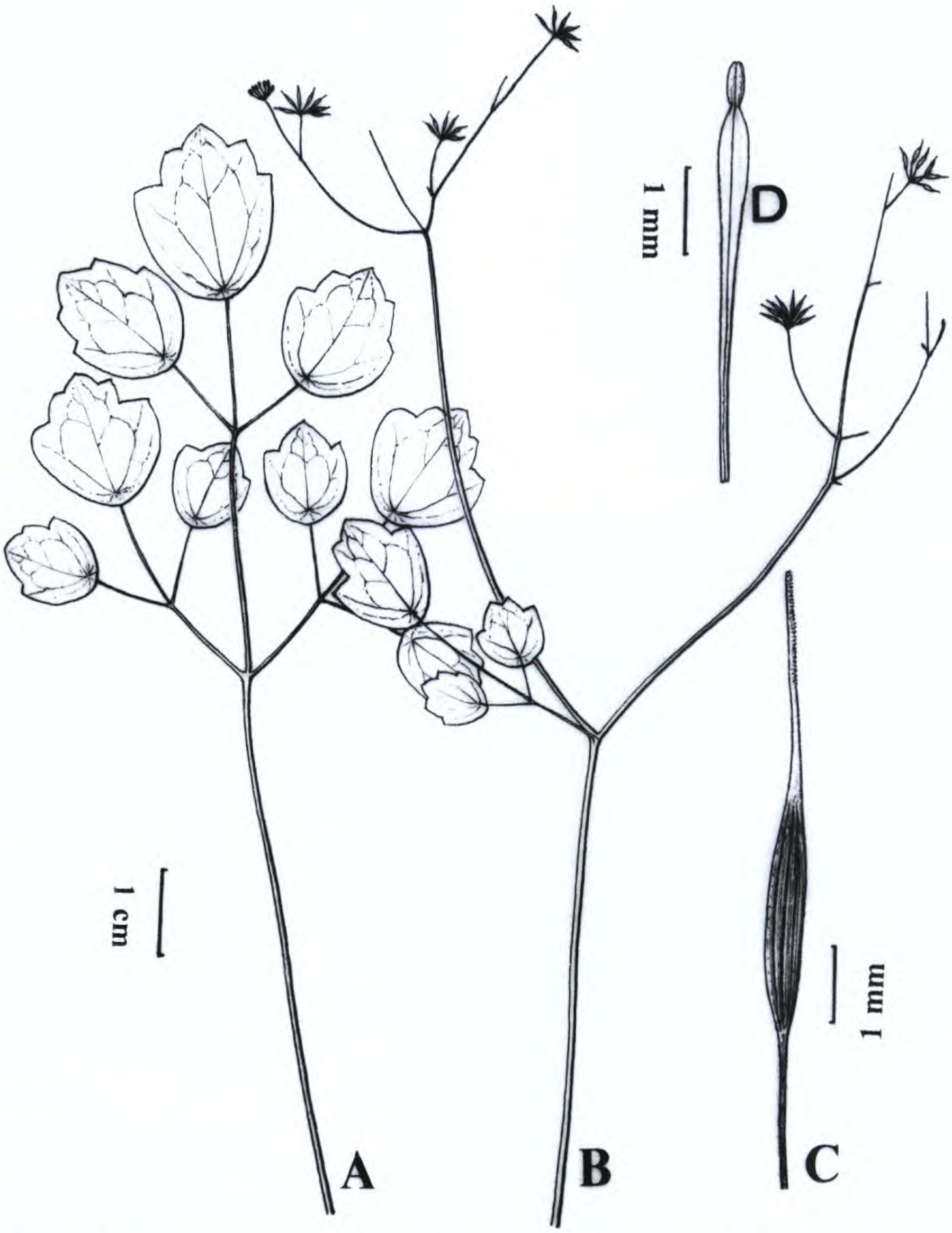

Figure 1. *Thalictrum pseudoichangense* Q. E. Yang & G. Zhu. —A. Basal leaf. —B. Flowering branch. —C. Achene. —D. Stamen. Drawn from the type, *H. J. Esquirol s.n.* (K).

Considering our new species is very similar to *Thalictrum ichangense* in general appearance, we name it *T. pseudoichangense.*

Thalictrum pseudoichangense Q. E. Yang & G. Zhu, sp. nov. TYPE: China. Guizhou: precise locality (southwestern Guizhou?) and date unknown, *H. J. Esquirol s.n.* (holotype, K). Figure 1.

Haec species *Thalictro ichangensi* et *T. coreano* affinis foliolis peltatis et acheniis stipitatis, sed stylis multo longioribus, circiter 3 mm longis differt.

Herbs perennial, glabrous; stems 2, 15–25 cm tall, with a few distal branches. Basal leaves 2; petiole 4–5 cm long; leaf blade 2- or 3-ternate, 6–12 × ca. 5 cm; leaflets slightly peltate, thinly herbaceous, obovate, widely ovate or suborbicular, 0.8–2 × 0.7–1.5 cm, apex slightly obtuse or rounded, base subrounded, trilobed; lobe margins toothed; nerves flat on both surfaces; petiolule 1.7–3 cm long; cauline leaves ca. 3, similar to the basal ones but smaller, ca. 4 × 1.5 cm. Inflorescence monochasial; pedicel slender, ca. 5 mm long. Flowers with sepals caducous; stamens ca. 6 mm long; anthers elliptic, ca. 0.5 mm long; filaments clavate, gradually dilated upward, apex oblanceolate; carpels 5 to 6, long-stipitate; styles subequaling ova-

ries, ca. 3 mm long, ventrally indistinctly stigmatic in upper part. Achene body fusiform, ca. 3 mm long; veins ca. 8; stipe slender, ca. 2 mm long.

Thalictrum pseudoichangense, which is known thus far only from the type collection, is closely related to *T. ichangense* and *T. coreanum* in having peltate leaflets and stipitate achenes, but differs by having styles much longer, ca. 3 mm long, subulate in shape, ventrally indistinctly stigmatic. In the latter two species, the styles are very short and inconspicuous, ca. 0.3 mm long, and ventrally distinctly stigmatic. Based on their stipitate achenes, these three species are undoubtedly members in *Thalictrum* subg. *Thalictrum* sect. *Tripterium* DC. ser. *Clavata* W. T. Wang & S. H. Wang (= sect. *Physocarpum* DC.). This series is characterized mainly by having leaves herbaceous, styles usually very short, ventrally distinctly stigmatic, achenes stipitate, compressed, and unwinged (Wang & Wang, 1979). The series comprises ca. 27 species, mostly occurring in eastern Asia, 12 (including the present new species) in China, of which 9 are endemic to the country (Wang & Wang, 1979). It is noteworthy that in the series *Clavata*, *T. pseudoichangense* is the only species whose carpels have long styles which are ventrally indistinctly stigmatic, and thus might represent a primitive form (W. T. Wang, pers. comm.). Wang and Wang (1979) and Wang (1980) considered that in the genus *Thalictrum* the long styles which are ventrally indistinctly stigmatic, such as those of *T. javanicum* Blume, *T. faberi* Ulbrich, *T. robustum* Maximowicz, and *T. megalostigma* (Boivin) W. T. Wang, may represent a primitive state, whereas the short styles ventrally distinctly stigmatic, such as those of *T. baicalense* Turczaninow, *T. ichangense*, and *T. delavayi* Franchet, may represent a relatively derived state.

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Aleuritopteris gongshanensis (Pteridaceae), a New Species from Yunnan, China

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ABSTRACT. *Aleuritopteris gongshanensis* G. M. Zhang, a new species of Pteridaceae from Yunnan Province, China, is described and illustrated. The new species is very similar to *A. pseudoargentea* S. K. Wu, but differs in its ovate-deltate fronds with white farina abaxially, an indusial margin distinctly lacerate, and spores with a reticulate-cristate perine.

Key words: *Aleuritopteris*, China, Pteridaceae.

Aleuritopteris Fée is a middle-sized genus mainly distributed in Asia and Africa (Ching, 1941; Saiki, 1984a, 1984b; Shing & Wu, 1990; Wu, 1981). It is characterized by usually living in a xeric or semi-xeric habitat and having farina abaxially on fronds. This genus was reduced to synonymy of *Cheilanthes* Swartz by some pteridologists (Tryon et al., 1990). Recent studies (Gastony & Rollo, 1995), however, have shown that the species from the Old World are not closely related to those of real *Cheilanthes* from America and should belong to a different group. Here the authors prefer to accept *Aleuritopteris* rather than *Cheilanthes* as the generic name for the group from the Old World.

In revising the Chinese species of *Aleuritopteris*, the authors noticed that some specimens at PYU and PE were erroneously identified as *A. cremea* Ching (= *A. veitchii* (H. Christ) Ching). These specimens are distinguished by having finely dissected fronds, distinctly lacerate indusial margins, and spores with a reticulate-cristate perine. After examining the types of related taxa in *Aleuritopteris*, including *A. veitchii*, *A. pseudoargentea*, and *A. pentagona* Saiki, we confirmed that these specimens were different from the above known species.

Aleuritopteris gongshanensis G. M. Zhang, sp. nov. TYPE: China. Yunnan: Gongshan, Bingzhongluo, under thickets in dry, hot valley, ca. 1650 m, 28 June 1988, *W. M. Chu, H. Z. Yan, X. C. Zhang & G. F. Zhang 22789* (holotype, PYU; isotype, PE). Figures 1, 2.

Species *A. pseudoargenteae* affinis, sed laminis ovato-deltatis non pentagonis, subtus candido-farinosis, pinnis secundis a basalibus 1.5–4 cm remotis, ambitu conformibus sed minoribus aliquantum, indusiis margine laceratis, perisporis reticulato-cristatis differt.

Rhizomes short, erect, scaly; scales uniformly black or dark brown, concolorous, lanceolate, ca. 0.5 × 6 mm. Leaves monomorphic, clustered, 20–30 cm high; stipes 10–18 cm, longer than laminae, 1–1.5 mm diam., ebeneous, glossy, rounded adaxially, scaly at base (scales similar to those of rhizome); laminae ovate-deltate, caudate at tip, 8–13 × 4.5–8.5 cm, papyraceous or subcoriaceous, adaxially glabrous, abaxially with white farina, tripinnatifid at base; rachises similar to stipes, but sulcate adaxially; pinnae 5 to 8 pairs, usually opposite or sometimes alternate, oblique, sessile, basal pinnae largest, deltate, strongly inequilateral, 4–7 × 4–5 cm, bipinnatifid; pinnules 4 to 7 pairs, alternate; acroscopic pinnules much smaller, usually simple, ca. 8 × 3 mm, obtuse at apex, broadly adnate to costa; proximal basiscopic pinnules greatly enlarged, oblong, to 4 × 1.5 cm, pinnatifid; ultimate segments 4 to 5 pairs, oblong to ovate, ob-

Figure 1. *Aleuritopteris gongshanensis* G. M. Zhang. Drawn from the isotype, *W. M. Chu et al. 22789* (PE). —a. Habit. —b, c. Rhizome scales. —d. Ultimate segments. —e. Magnification of a segment. —f. Pseudoindusia.

tuse at apex, middle ones to 1.5 × 0.3 cm; second pinnae 1.5–4 cm apart from the basal ones, similar but smaller; upper pairs usually shorter than lower ones. Sori confluent at maturity; pseudoindusia narrow, membranous, continuous, with a lacerate margin. Sporangia 64-spored. Spores subglobose, 45 × 51 μm, with a reticulate-cristate perine.

Distribution and habitat. Specimens were collected only in northwestern and central Yunnan.

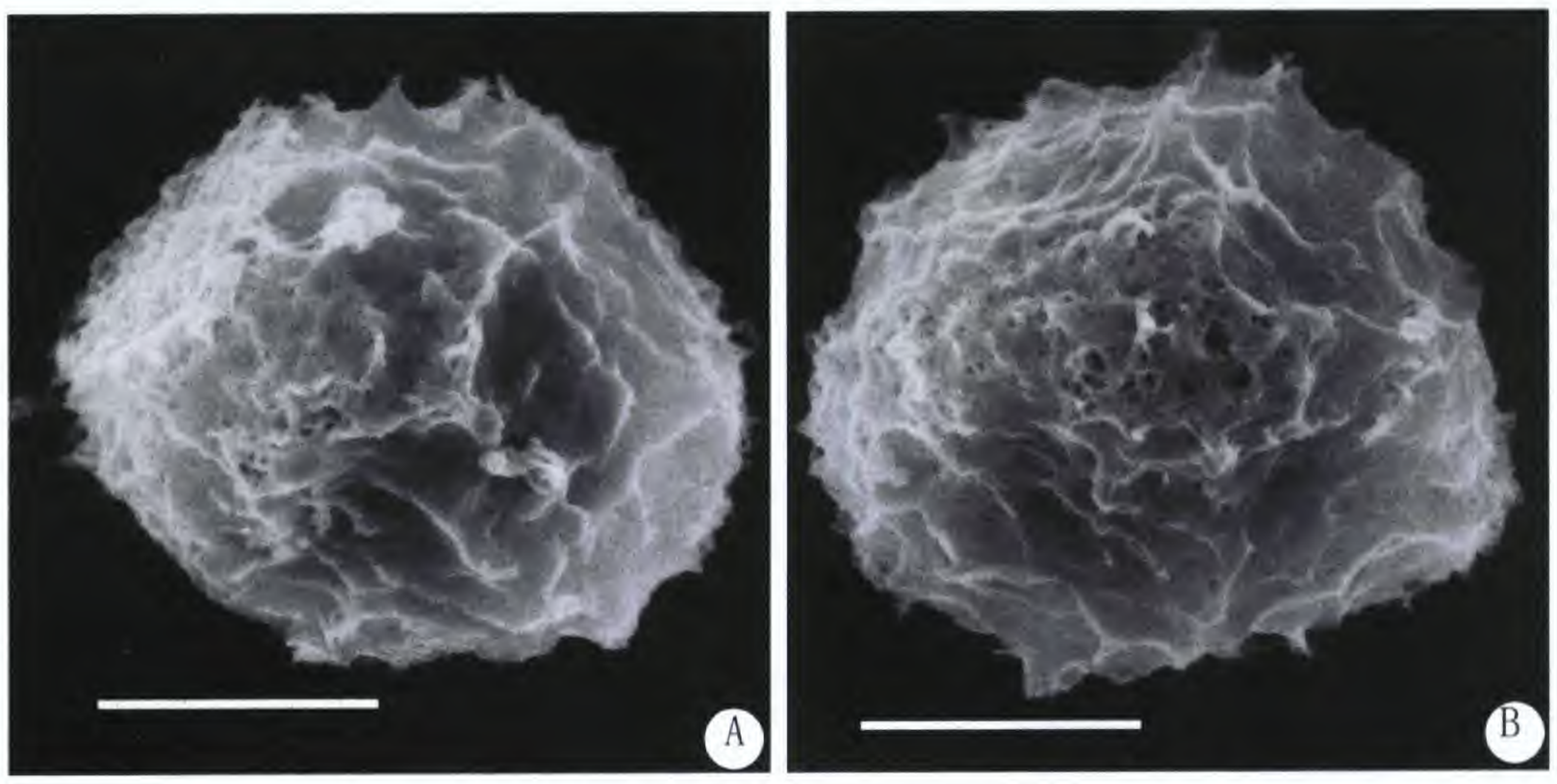

Figure 2. Spore morphology of *Aleuritopteris gongshanensis*. Spores taken from the isotype, *W. M. Chu et al. 22789* (PE). —A. Proximal view, ×780. —B. Distal view, ×780. Bar length = 23.1 μm.

The species usually grows under thickets in dry, hot valleys at ca. 1030–1700 m.

Aleuritopteris gongshanensis is similar to *A. pseudoargentea* and *A. veitchii* in its concolorous rhizome scales, but differs in its ovate-deltate fronds with white farina abaxially, an indusial margin distinctly lacerate, and spores with a reticulate-cristate perine. The new species is also similar to *A. pentagona*, but differs in its concolorous rhizome scales. The main differences between these species are summarized in the following key.

KEY TO *ALEURITOPTERIS GONGSHANENSIS* AND ITS RELATED SPECIES

1a. Scales on the rhizome dark brown to black, concolorous.
  2a. Indusial margin entire or slightly sinuous; fronds abaxially with yellow or light yellow farina.
    3a. Fronds coarsely dissected; spores with a reticulate perine . . *Aleuritopteris veitchii*
    3b. Fronds finely dissected; spores with a cristate perine . . . . . *Aleuritopteris pseudoargentea*
  2b. Indusial margin distinctly lacerate; fronds abaxially with white farina . . . . . *Aleuritopteris gongshanensis*
1b. Scales on the rhizome bicolorous, with dark central stripe and lighter margins . . . . . *Aleuritopteris pentagona*

Paratypes. CHINA. **Yunnan:** Gongshan, Bingzhongluo, 20 June 1985, *W. M. Chu et al. 17681* (PYU), *Qinghai-Xizang Exped. 7400* (KUN), 25 May 1960, *S. Jiang et al. 8745* (KUN, PE, PYU); nearby Gongshan county town, 3 Sep. 1988, *W. M. Chu et al. 22239* (PYU); Lushui, 14 Oct. 1988, *W. M. Chu et al. 22969* (PYU); Yimen, Xiaolüzhi, 20 Oct. 1965, *W. M. Chu 4664* (PYU), 26 Apr. 1983, *W. M. Chu et al. 15850* (PE, PYU).

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